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Forest pest conditions in the Maritimes 1984

Laszlo P. Magasi
Maritimes Forest Research Centre

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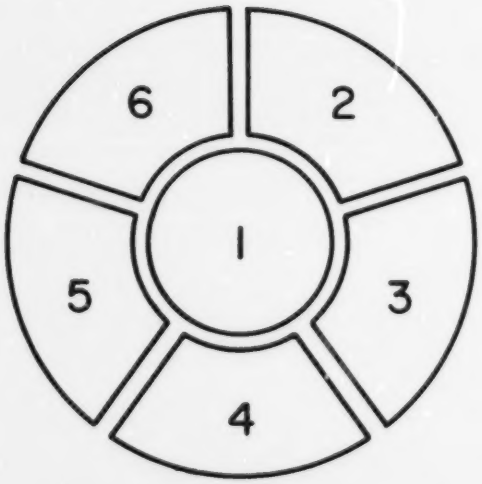
MARITIMES FOREST RESEARCH CENTRE

The Maritimes Forest Research Centre (MFRC) is one of six regional establishments of the Canadian Forestry Service, within Agriculture Canada. The Centre conducts a program of work directed toward the solution of major forestry problems and the development of more effective forest management techniques for use in the Maritime Provinces.

The program consists of three major elements - research and development, technical and information services, and forest resources development. Most research and development work is undertaken in direct response to the needs of forest management agencies, with the aim of improving the protection, growth, and value of the region's forest resource for a variety of consumptive and nonconsumptive uses; studies are often carried out jointly with provincial governments and industry. The Centre's technical and information services are designed to bring research results to the attention of potential users, to demonstrate new and improved forest management techniques, to assist management agencies in solving day-to-day problems, and to keep the public fully informed on the work of the Maritimes Forest Research Centre.

The forest resources development branch is responsible for development, implementation, and administration of joint federal/provincial forest resources development agreements in the three Maritime provinces, for the creation of employment opportunities in the development of the forest resources, and for providing economic information to landowners and decision-makers for identifying and evaluating forest management alternatives.



1. A cone rust on white spruce.
2. A needle rust on pine.
3. Globose gall rust.
4. White pine blister rust.
5. Sweetfern blister rust.
6. A needle rust on balsam fir.

FOREST PEST CONDITIONS IN THE MARITIMES IN 1984

by

Laszlo P. Magasi

Maritimes Forest Research Centre

Fredericton, New Brunswick

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ABSTRACT

This report reviews the status of forest insects and diseases in the Maritimes Region in 1984, damage related to forest inventory data, and a forecast of conditions for 1985, when appropriate. Fifteen economically important pest conditions are discussed in detail. A chapter on special surveys introduces the Canadian Forestry Service's Acid Rain - National Early Warning System (ARNEWS) as it relates to the Maritimes, includes a statement on forest pest assessments in plantations and provides information on the results of cyclical reviews for specific pests. Information on other organisms is listed in tabular form. A list of forest-pest related publications and reports is included. More detailed information is available on request from the Maritimes Forest Research Centre.

RESUME

Ce rapport fait le bilan des insectes et maladies des arbres dans la région des Maritimes en 1984, cite les pertes occasionnées à l'inventaire forestier, et donne un aperçu des conditions prévues pour 1985, lorsqu'approprié. On y traite en détail de 15 ravageurs importants. Un chapitre consacré aux inventaires spéciaux explique le Système National Pluies Acides - Premiers Avertissements dans son contexte des Maritimes, présente un rapport sur l'évaluation de ravageurs forestiers en plantations, et donne de l'information sur les résultats de revues cycliques faites sur certains ravageurs en particulier. Des informations sur d'autres organismes sont incluses sous forme de tableau. De plus amples renseignements sont disponibles sur demande au Centre de recherches forestières des Maritimes.

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INTRODUCTION

Some of the objectives of the Forest Insect and Disease Survey are to monitor insect and disease conditions, determine their effects on the forest, and report on the status of the important and more common pests. In the Maritimes, this information is disseminated to interested agencies and individuals through periodical reports such as Seasonal Highlights, Technical Notes, Information Reports, and the Annual Report of the Forest Insect and Disease Survey.

In this report, pest conditions in 1984 are described and, where appropriate, related to provincial forest inventory data; operational control programs against the spruce budworm are summarized; and a list of reports and publications relating to forest-pest conditions is included.

The report aims to provide forest managers with information on pest conditions in the Maritime Provinces, early enough to be considered in management decisions before the start of the 1985 field season. Insects and diseases that were widespread and caused considerable concern in 1984 are discussed in detail, others are presented in tabular form. More information on these and on other specific conditions will be provided upon request from the Maritimes Forest Research Centre.

Since 1982, we have presented a chapter on special surveys to report on some of our projects that have implication in forest management but did not fit our previous reporting format. Because of other priorities in 1984, special surveys were restricted, to cyclical reviews for specific pests. However, plantation assessments and condition surveys for specific forest tree species will hopefully resume next year.

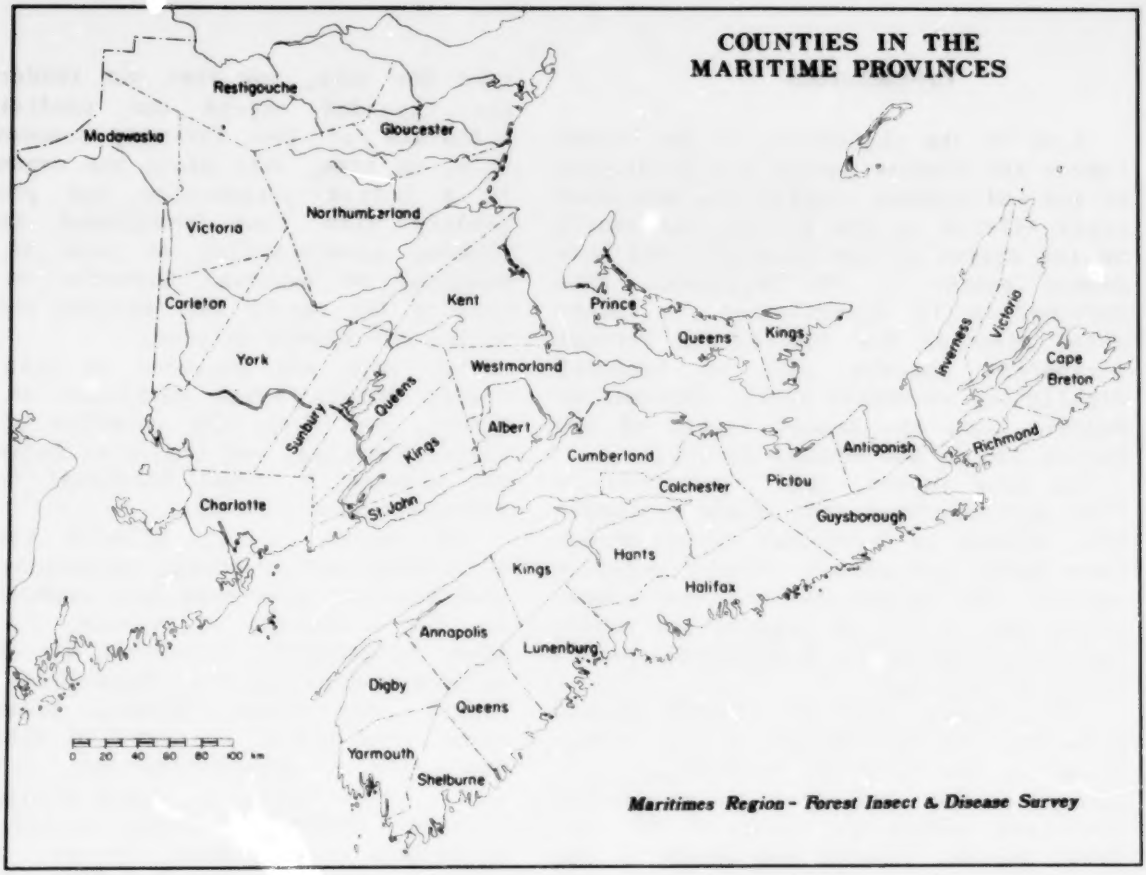
A new chapter this year deals with the establishment of the Acid Rain - National Early Warning System.

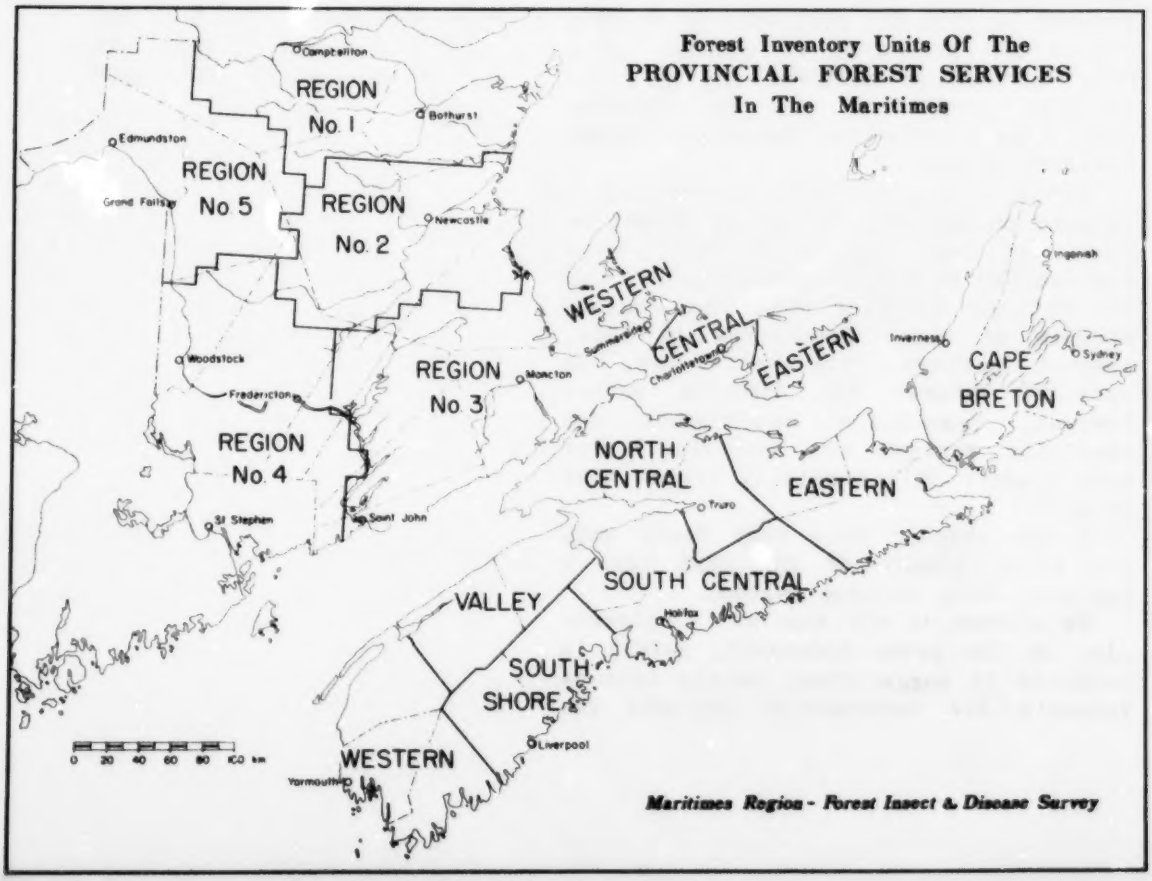
We attempt to add some extra information on the pests discussed, partly in response to suggestions, partly because requests for information indicate the need for this, now that our readership has expanded beyond our traditional clientele of the forestry community. This, we hope, will place the organisms in a better perspective and provide readers with some background and a clearer understanding of some of the concerns we express. Comments on any part of the report for improved presentation are always welcome.

Two maps are included to help the reader locate areas mentioned in the report, one shows the counties of the three provinces, and the other indicates the provincial forest services' forest inventory subdivisions.

In recent years, efforts towards collecting and reporting information in quantitative terms have been emphasized, but for a variety of reasons, it will never be possible to express all observations quantitatively. Throughout this report, the terms "severe, moderate, light, and trace" are used to describe the level of defoliation and, in some cases, other injury or insect population levels. Unless otherwise stated, the terms have the following ranges:

Trace	up to 5%
Light	6 - 29%
Moderate	30 - 69%
Severe	70 - 100%


COUNTIES IN THE
MARITIME PROVINCES
Restigouche
Madawaska
Gloucester
Victoria
Northumberland
Carleton
Kent
Prince
Queens
Kings
Inverness
Victoria
Cape
Breton
York
Westmorland
Sunbury
Queens
Albert
Kings
Cumberland
Antigonish
Richmond
Colchester
Pictou
Charlotte
St. John
Guysborough
Hants
Kings
Halifax
Annapolis
Lunenburg
Digby
Queens
Yarmouth
Shelburne
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey


Forest Inventory Units Of The
PROVINCIAL FOREST SERVICES
In The Maritimes
Campbellton
REGION
No. 1
Bathurst
Edmundston
REGION
No. 5
Grand Falls
REGION
No. 2
Newcastle
WESTERN
CENTRAL
EASTERN
Inverness
Ingonish
Sydney
CAPE
BRETON
Woodstock
REGION
No. 3
Moncton
Fredericton
REGION
No. 4
NORTH
CENTRAL
EASTERN
St. Stephen
Saint John
Truro
SOUTH CENTRAL
VALLEY
Halifax
SOUTH
SHORE
Liverpool
WESTERN
Yarmouth
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

IMPORTANT AND CONSPICUOUS FOREST PESTS

SPRUCE BUDWORM

Information presented on the spruce budworm, Choristoneura fumiferana (Clem.) is summarized from various sources: New Brunswick Department of Natural Resources, Forest Protection Limited, J.D. Irving Limited, Nova Scotia Department of Lands and Forests, Prince Edward Island Department of Energy and Forestry, and the Maritimes Forest Research Centre. Both published and unpublished data were used with permission, and the cooperation of all organizations is acknowledged. More detailed information is available from the various sources.

NEW BRUNSWICK

Defoliation of balsam fir and spruce stands was recorded as severe and moderate over 730 000 ha in the Province in 1984 (Fig. 1). Inclement weather before and during the aerial survey period resulted in a considerable amount of reddened foliage being washed off the trees. This in turn necessitated extensive ground surveys to supplement aerial survey information. Because of these difficulties, it was necessary to combine the severe and the moderate defoliation categories and impossible to determine the area where light defoliation occurred. Consequently, the "traditional" area of total defoliation was unavailable.

The 730 000 ha severe and moderate defoliation caused by the spruce budworm in 1984 represents a significant decline from the 2 028 000 ha recorded in these categories in 1983.

Damage There were no specific surveys conducted in 1984 by either the New Brunswick Department of Natural Resources or the Forest Insect and Disease Survey. Tree mortality as a result of repeated spruce budworm defoliation occurred over undefined areas of susceptible forest throughout the Province. However, given the decrease in defoliation in 1984, it is likely that the rate of mortality in 1984 has not increased over that of previous years.

Control operations Foliage protection against the spruce budworm in New Brunswick was conducted over 1 245 500 ha in 1984, 1 030 500 ha by Forest Protection Ltd., Fredericton, and 215 000 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd., Saint John, N.B. Forest Protection Ltd. treated 488 600 ha with fenitrothion; most of it with a double application of 210 g/ha and some small areas with single applications of either 210 or 280 g/ha. Aminocarb (Matacil) was used over 504 600 ha, of which 117 800 ha was treated once at 90 g/ha and 386 800 ha treated twice at a dosage of 70 g/ha per application. Both chemicals were applied in water-based formulations. The bacterial insecticide B.t. (Bacillus thuringiensis) (Thuricide 48 LV®) was applied undiluted to 37 300 ha at a dosage of 30 BIU/ha in a single application. Forest Patrol Ltd. treated 215 000 ha with fenitrothion with two applications.

Forecast Egg-mass surveys were conducted at 1476 points in the Province in 1984. Population levels of spruce budworm were forecasted to be high to very high at 27%, moderate at 22%, and low at 51% of the locations sampled. These results indicate that moderate to severe infestations might be expected over 3.75 million ha in New Brunswick in 1985.

NOVA SCOTIA

Defoliation of balsam fir and spruce in softwood and mixedwood stands occurred on 85 100 ha in Nova Scotia in 1984 (Fig. 1). Defoliation was severe on 25 900 ha, moderate on 32 800 ha, and light on about 26 400 ha. The 58 700 ha of moderate and severe defoliation is a substantial decrease from the 294 000 ha so affected in the Province in 1983. The previously identified outbreak areas are discussed briefly to provide for historical continuity in reporting.

In Colchester-Cumberland counties the area of severe and moderate defoliation decreased to 30 200 ha in 1984 from 177 500 ha in 1983.

On the Northumberland Strait coast of Pictou and Antigonish counties, defoliation was severe or moderate on 21 500 ha in 1984 compared with 54 700 ha so defoliated in 1983. This was the smallest area affected since 1981 when 12 600 ha were in the severe or moderate defoliation categories.

In Annapolis Valley-Hants County there was no defoliation recorded in the severe or moderate categories in 1984. There had been 44 000 ha of severe or moderate defoliation in 1983 but, in 1982, only 4 100 ha of moderate defoliation occurred in this area.

On Cape Breton Island, there was no defoliation recorded in the severe or moderate categories in 1984. This compares with 17 700 ha of defoliation in 1983 and with 400 ha of moderate defoliation recorded in 1982. However, in many of these areas, tree mortality previously was in excess of 75% and defoliation occurred on the residual surviving trees, mostly on white spruce and occasionally on black spruce.

Damage surveys were not conducted in Nova Scotia in 1984. In 1983, an estimated 1.4 million m^3 balsam fir and 0.5 million m^3 spruce died as a result of repeated defoliation by spruce budworm and attacks on spruce by the spruce beetle. This amount of annual wood loss is expected to decrease gradually as the effects of the massive defoliation in the late 1970s and early 1980s wear-off in the most severely affected areas where there are fewer and fewer trees left to die.

Mortality of merchantable balsam fir has been followed on permanent research plots on both the Highland and Lowland areas of Cape Breton Island, since 1976. Although spruce budworm populations have decreased drastically from those at the height of the outbreak, losses continued to mount with many of the weakened trees falling victim to a complex of secondary organisms, and in recent years to blowdown.

On the Highlands, 83.3% of the original trees had been lost by the fall of 1984, 69.2% to mortality and 14.1% to blowdown. The increase in total losses from 1983 was 6.4%. On the Lowlands, where losses were much lower at the beginning of the outbreak, mortality has accelerated during the past few years. Mortality and blowdown in 1984 amounted to 92.4% on the research plots, compared with 90.4% in 1983. The apparent slowdown in losses is a classical case of 'not much left to die' at these levels of stand destruction.

Control operations against the spruce budworm were conducted by Nova Scotia Department of Lands and Forests. In 1984, 20 537 ha were treated in the Province. Although there were treatment areas in Cumberland, Colchester, Pictou, and Kings counties, 96% of the treated area was in Cumberland County. All treatment was with the biological insecticide B.t. which was applied at either 20 or 30 BIU/ha dosage. All but 1% of the treated area received one application.

Forecast Based on predictive surveys, both egg mass and L_2 surveys, the Nova Scotia Department of Lands and Forests expects most of the severe and moderate defoliation to occur in Cumberland, Colchester, Pictou, and Antigonish counties, primarily along the Northumberland Strait coast, in 1985. A significant increase is predicted in both the area affected and the intensity of expected defoliation within the areas so affected. Moderate defoliation is expected to occur in a small area of Kings County with defoliation light elsewhere in other parts of the Province.

PRINCE EDWARD ISLAND

Defoliation of balsam fir and spruce stands occurred on 15 600 ha in Prince Edward Island in 1984 (Fig. 1), less than half of the 43 400 ha affected in 1983 and almost equal to the 15 300 ha defoliated in 1982. Defoliation was classified as follows, with the 1983 figures in brackets: severe on 8 200 ha (8 500 ha), moderate on 6 900 ha (13 700 ha) and light on 500 ha (21 200 ha). Severe and moderate defoliation occurred mainly in eastern Prince County, in southern Queens County and southwestern Kings County.

Damage surveys were not conducted in the Province in 1984 but considering the decrease in spruce budworm caused defoliation and spruce beetle activity (see p. 7), the damage figures given for the Province in 1983 should represent a maximum loss for 1984. In 1983, it was stated that "an estimated 60 000 m^3 balsam fir and 80 000 m^3 spruce died in Prince Edward Island in 1983 as a result of repeated defoliation by spruce budworm and attacks on spruce by the spruce beetle."

Control No control measures on an operational scale were carried out against the spruce budworm in Prince Edward Island.

Forecast Egg-mass surveys replaced L_2 surveys in 1984 to provide predictions for 1985. Overwintering spruce budworm populations were high on 58%, medium on 33%, and low on 8% of the locations sampled. A significant increase is expected in the area of defoliation in 1985 and severe defoliation is likely to occur in all three counties of the Province.

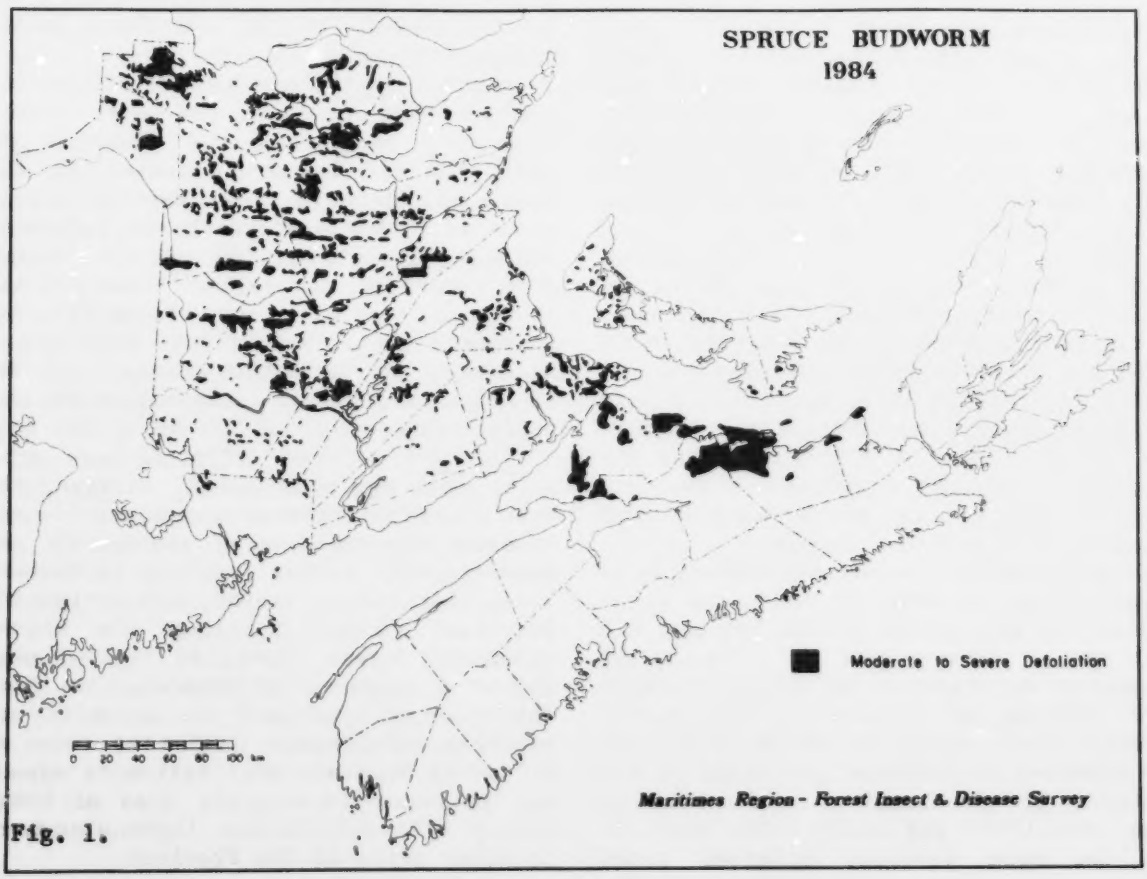


Fig. 1.

SPRUCE BUD MOTH

Spruce Bud Moth, Zeiraphera canadensis Mutuura & Freeman, and to a lesser degree, a closely related species, Zeiraphera unfortunana Powell, have been omnipresent forest pests in the Maritimes for as long as Forest Insect and Disease records have been kept, since late 1930s. Although widespread, insect populations have been generally low except for the occasional flareup, usually on open-grown white spruce. The last recorded outbreak occurred in New Brunswick in the mid-1960s when spruce in parts of the Southwest Miramichi and the Nashwaak River drainage systems sustained moderate to severe defoliation, and in Nova Scotia in the mid-1970s when similar levels of defoliation occurred in areas along the Northumberland Strait and the Fundy Coast.

Spruce bud moth, a not-too-important forest insect in mature forests, became a major pest when, in 1980, it was discovered to be causing defoliation, shoot distortion, and tree deformation in white spruce plantations over large areas in New Brunswick. In 1982, over two-thirds of the 180 locations surveyed in the Region were infested by spruce bud moth. At over 40% of these locations, in both New Brunswick and Prince Edward Island, defoliation and shoot damage were in excess of 10% and were classed as moderate or severe at 10 and 20%, respectively, of the locations in those provinces.

In 1984, spruce bud moth was widespread throughout much of New Brunswick but populations were highest and damage most obvious in the northwestern part of the Province. Defoliation and shoot damage was pronounced on white spruce, providing a sharp contrast to the green and undamaged red and black spruce in the same area. While Z. canadensis remained the most frequently encountered spruce bud moth species, Z. unfortunana, was found in significant numbers at one-third of the locations where spruce budmoths were observed, mostly in the northcentral area of the Province. At one location, there were twice as many Z. unfortunana larvae counted as there were Z. canadensis. Populations of the spruce bud moth were low in both Nova Scotia and Prince Edward Island.

BARK BEETLES OF CONIFERS

Not as conspicuous as some defoliators, bark beetles nonetheless are an important group of forest insects causing tree mortality. Bark beetles usually attack trees that have been weakened by other factors but when populations are at outbreak levels, healthy trees are successfully attacked and may be killed.

Spruce Beetle, Dendroctonus rufipennis (Kby.) attacks continued throughout the Region in 1984, although there was a marked decrease in the number of white spruce trees newly affected in most areas, compared with 1983 when spruce beetle activity was very high. There also was a marked extension in the distribution of the insect in New Brunswick (Fig. 2).

In Nova Scotia, Cape Breton Island has constituted the major outbreak area during the past few years and by the end of 1983 no large areas remained without severe white spruce mortality. In 1984, new mortality occurred only in patches in the western and northern parts of the Island, generally with less than 10% of the remaining trees being affected. However, more than half of the white spruce trees, especially the more mature ones, are now dead as the result of the outbreak in many areas. On the mainland, white spruce mortality was also much reduced from last year and was observed only in a few isolated pockets.

In Prince Edward Island, spruce beetle activity occurred in Queens and Kings counties in previously affected areas but few newly attacked trees were observed. With about a third of the Province's merchantable white spruce having succumbed to this insect in past years, the spruce beetle remains a serious threat to both forestry and agriculture, because many of the trees killed are in the hedgerows and windbreaks.

In New Brunswick, the small infestations reported in previous years remained active and more mature white spruce

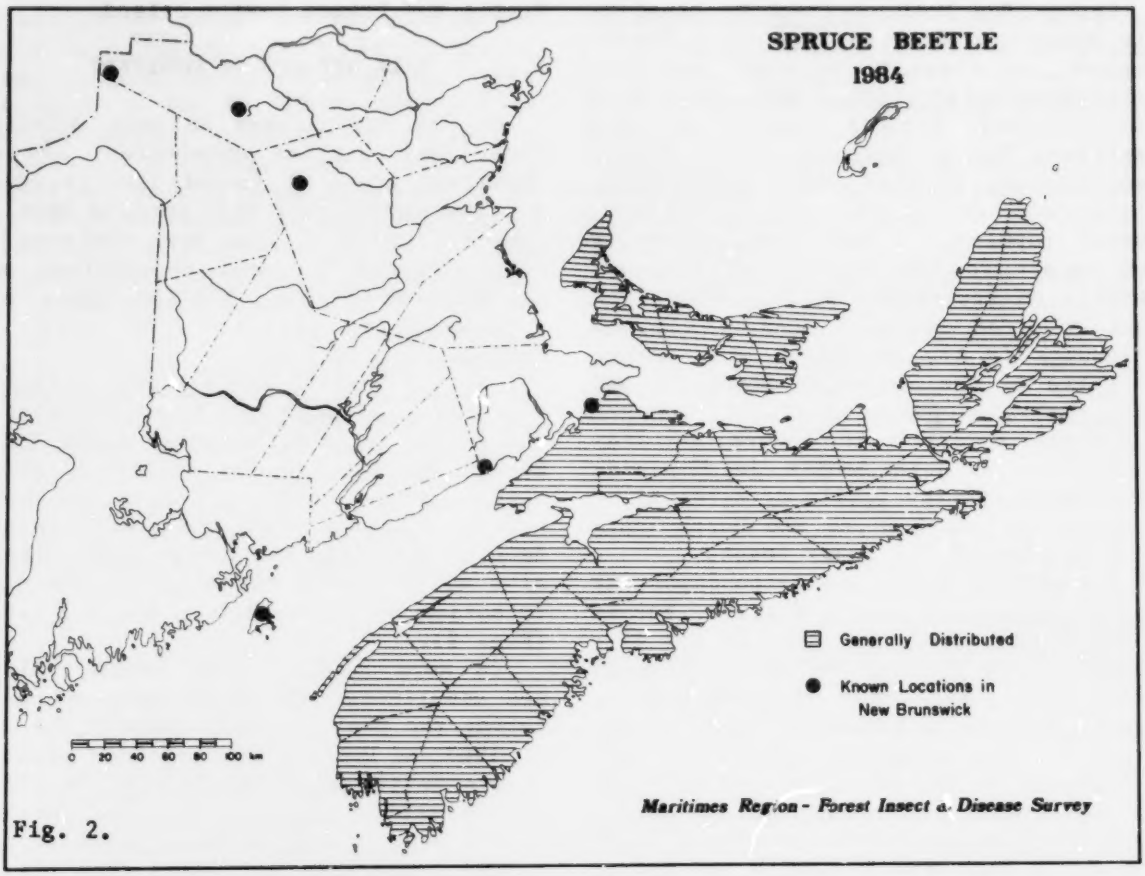

SPRUCE BEETLE
1984
Generally Distributed
Known Locations in New Brunswick
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 2.

trees were attacked. In Fundy National Park, nearly a third (32%) of the trees are dead or dying from beetle attack on the Cross Fundy Trail. Up to 1984 all areas where the spruce beetle was known to occur were in the extreme south part of the Province. In 1984, spruce beetle infested trees were found in several areas in northern New Brunswick, in Restigouche and Northumberland counties. While these areas are small and currently only a few trees are affected at each location, they constitute a significant change in the distribution of the insect, are widely separated, and are situated in areas where the condition of trees could be conducive to a build-up of spruce beetle populations.

Eastern Larch Beetle, Dendroctonus simplex Lec., normally attacks only weakened, damaged, or recently felled host material. However, when populations are very high, living, apparently healthy, mature, or overmature trees, and even younger small diameter trees can also become infested.

In the Maritimes, a population build-up was first noticed in Nova Scotia in 1976. This increase in beetle populations followed several years of severe defoliation of larch by the larch sawfly, Pristiphora erichsonii (Htg.). Since then, the beetle has become widespread in all three provinces and has caused serious tree mortality. By the end of 1981, when the last detailed

survey for this insect was conducted, an estimated 24% of merchantable-size larch was dead in New Brunswick, 64% in Nova Scotia, and 13% in Prince Edward Island.

In 1984, there was no dramatic change in the status of the insect in the Region. Dying trees were observed at several locations, notably near Cloverdale, Carleton County, N.B. where many dead and dying trees were seen throughout the area and near Ross Corner, Prince County, P.E.I. where, at the site of the only known active infestation in the Province, a few mature and semimature trees succumbed to attacks. At the central New Brunswick research plot, a further 3.8% of the trees became infested in 1984 (compared with 2.9% in 1983) and a further 1.9% of the trees died (compared with 2.9% in 1983).

CANKERS OF CONIFERS

Cankers are caused by many fungi, the attacks of which are manifested in different ways. However, all are similar in one important aspect: they damage trees. Damage varies from the loss of a few small branches or minor stem infections to the deformation of the stem to such an extent that it becomes of little or no value, or the tree may die. Damage in stands is also variable. Some canker diseases eliminate but a few trees, while others may spread and infect most or all trees in a stand or plantation. Losses are both direct, such as reduction in wood value, and indirect, such as low quality trees occupying valuable space, or affected trees serving as sources of infection either to other trees in the same stand or to areas nearby.

European Larch Canker, caused by the fungus Lachnellula willkommii (Hartig) Dennis, was first discovered in the Maritimes in 1980. Surveys since then established the distribution of the disease as widespread in southeastern New Brunswick and on mainland Nova Scotia. European larch canker has been a serious disease in many parts of Europe. The fungus is considered, by most, to be a primary pathogen (capable of infecting vigorous, healthy trees) and its presence in Europe has resulted in the exclusion of larch from plantation programs. In North America, the fungus was found in Massachusetts in the 1920s in European larch plantations. Periodic concentrated eradication attempts appear to have been successful as the disease was not found during surveys of the area in 1965. However, it was found in northeastern Maine in 1981.

The fungus infects mostly young trees, therefore, future wood supplies may be affected. Tree mortality reduces stocking, branch mortality reduces growth, and cankers reduce wood quality. The extent to which the disease will cause damage in the Maritimes is not yet known but the potential for damage is there and the role of the disease will have to be considered in view of increased emphasis on forest renewal and larch tree improvement programs.

In 1984, a stand was found infected outside the known range of the disease, at Leverville, Charlotte County. It is questionable whether this find is a genuine extension or a refinement of the border line as the stand is situated just outside the known range and 53% of the trees examined were cankered. Surveys elsewhere in New Brunswick and at the 48 locations in Prince Edward Island failed to detect infected trees.

Investigation of several aspects of the behavior of the fungus under our climatic conditions has been initiated. Results will be reported as they become available. A survey to establish age and spread pattern indicates that the fungus could have been present in the Maritimes for about two decades before its discovery and may have spread from specific areas. The study also showed a rapid decrease in incidence of infected trees with increasing distance from the southern shores of the Bay of Fundy, possibly indicating a climatic dependence.

The disease is capable of intensifying rapidly in young stands. Incidence of infected trees in a research plot increased as follows, based on fall assessments: 1982 - 7%; 1983 - 19%; and 1984 - 46%.

A few, (5-10) 1-yr-old, greenhouse-grown seedlings from each of 30 provenances of Larix decidua, L. leptolepis, L. eurolepis, L. laricina, and L. sibirica were planted in a heavily infected area in the early summer of 1983 to test differences in susceptibility to infection. Cankers, bearing fruiting bodies of Lachnellula willkommii, were found on three seedlings in the fall of 1984. All three infected seedlings were Larix decidua, two on provenances from Denmark, and one from Czechoslovakia.

Scleroderris Canker, caused by the fungus Gremmeniella abietina (Lagerb.) Morelet, was first found in the Maritimes Region in 1971. The disease is widespread in New Brunswick, especially in the northern half of the Province and infects mostly plantations of jack, red, and Scots pine. In Nova Scotia, where the disease was first found in 1972, a few plantations of red, jack, and Scots pine suffered limited lower branch mortality during the mid-1970s. The disease was last found in that Province in 1978, and appears to have died out. It has never been found in Prince Edward Island.

The European race of the disease, which is capable of killing trees of any size (the North American race kills only small trees), and several other "intermediate" races have been found in New Brunswick since 1978; however, symptoms and damage expression are indistinguishable. Plantations infected by these races have either been removed or are under close surveillance for changes in symptom expression.

In 1984, the disease was observed in several areas in New Brunswick but the anticipated increase in new infections did not materialize. There was a 3% increase in the number of infected trees at the study plot at Lisson Settlement, Kings County, the most active spread area in the Province this year. No symptoms of the European race of the disease were reported.

SIROCOCCUS SHOOT BLIGHT

Sirococcus Shoot Blight, caused by the fungus Sirococcus strobilinus Preuss, has been known in the Maritimes for only about a decade but has been present for much longer. The fungus infects and kills newly developed shoots. It produces fruiting bodies on the twigs, needles, and cone scales from whence the spores are dispersed and cause new infection. Heavy attacks cause branch mortality, which results in crown dieback and tree mortality. Although, in the Maritimes, the disease affects mostly red pine and occasionally spruce, other species of pine, larch, hemlock, Douglas fir, and true firs can also be affected. Trees of any size, from seedlings to 15 m in height, are damaged or killed.

The disease is present in all three provinces but is most widely distributed in red pine plantations in Nova Scotia, west of the Colchester-Pictou and Halifax-Guysborough county lines, and in natural regeneration in the south and central part of New Brunswick.

In 1984, the disease intensified in the affected areas. In a young red pine plantation in Pictou County, Nova Scotia with one infected tree in 1983, the incidence of the disease has increased to about 5%. At Iona, Queens County, P.E.I., the only location found infected in 1983, 14% of the trees (about 12 m in height) sustained up to 10% shoot mortality, most of damage having occurred in one section of the plantation. The level of infection on regeneration at McDougall Lake, Charlotte County, N.B., was again moderate to severe.

In addition to causing damage to trees, the fungus was found on white spruce cone scales at 15 of the 33 locations (45.5%) assessed in New Brunswick: these locations were widely distributed throughout the province. At infected locations an average of 25% of the cones harbored the fungus. Incidence ranged from 1% at four locations to 94% at Birdton, York County and 97% at Kerry Brook, Albert County. The significance of this is that S. strobilinus may be

carried to other areas, such as nurseries, on the cones and if these are disposed of improperly could become a source of infection.

ARMILLARIA ROOT ROT

Armillaria Root Rot, Armillaria mellea (Vahl ex Fr.) Kummer, a disease of a wide variety of tree species of various ages has always been a part of the forest disease complex in the Maritimes but its significance appears to have changed in recent years. On the one hand, the fungus is strongly implicated among the group of secondary organisms that combine to provide the final blow to trees weakened by other factors such as repeated defoliation by the spruce budworm. On the other hand, Armillaria infected or killed trees are becoming more frequent throughout the Maritimes, and are often observed in plantations. The increased frequency is doubtless a factor of the increase in the areas planted. The implications of the root rot to the future of plantations under our climate are poorly understood. However, the disease is killing trees in plantations. In some areas, groups of trees are affected and there is evidence that with the spread of the fungus these patches could increase in size. In other areas, only scattered trees are infected but these could become centers of infection if the fungus spreads. Not all infected trees die, the fungus is primarily a wood decay organism causing root and butt rot, but its action may cause understocking in both plantations and natural stands.

The disease is widely distributed in the Region and mortality of trees, both young and old, was again common in 1984. As many as 28% of semimature balsam fir were found dead at Sisters Brook, York County; 12% of young larch trees were killed at Langley, Victoria County; 4% of the jack pine were infected in a 3-year old plantation near Napadogan, York County; several larch trees were removed from a seed orchard near Sussex, Kings County in New Brunswick because they were infected.

Plots in which the spread of the disease on different hosts under different conditions can be studied, are being established as suitable areas become available. There appear to be differences in the rate of spread of Armillaria affected trees in four black spruce plantations. The plantations are of different ages and established in areas of somewhat different former cover-type (Table 1). It is too early to speculate whether the differences are the result of trees in the older plantations becoming less susceptible to infection after overcoming early planting shock or to differences in the amount to inoculum present, depending on the composition of the former forest stand.

Table 1. Armillaria root rot - spread of the disease in black spruce plantations (plots established in 1983).

Year planted	Former cover	Percent mortality 1983	1984
1973	Softwood	4	4
	Hardwood		
1976	Softwood	8	10
1978	Softwood	8	12
	Hardwood		
1980	Softwood		
	Hardwood	8	16

CONE RUSTS

Cone rusts, because of their potential to interfere with seed production, are among those forest diseases that have a direct impact on all aspects of forestry in both the short and the long term. In 1984, cone rusts were one of the major forest disease problems of white spruce in New Brunswick.

The fungus, Pucciniastrum americanum (Farl.) Arth., has been previously reported on cone scales in Canada only from British Columbia in 1962 and from New Brunswick in 1982 and 1983. In the past it has been considered a needle or cone rust of no significance. In 1984, there was a bumper cone crop on white spruce in New Brunswick and the weather was wet and humid in the early part of the season. The combination of the presence of cones, ideal conditions for spore germination, and the abundance of raspberry, the alternate host required by P. americanum to complete its life cycle resulted in very high levels of infection of white spruce cones throughout much of New Brunswick (Fig. 3). In some areas the infection was so heavy that, from a distance, the tops of trees actually appeared yellow from the generous production of spores.

Of 49 areas surveyed for cone rust, the fungus was found in 46, the incidence of infected cones in these 46 areas was 57.7% (range 1 to 100% of cones infected). This figure is based on an average of 135 cones examined per location (range 18 to 300 cones). The severity of infection on individual cones varied greatly from a single infection spot affecting 1-3 cone scales, to as much as 75% of the cone surface covered by the fungus. In general, heavily infected cones were smaller than normal, appeared withered, and many were later overgrown by secondary fungi. The effects of infection on seed production and viability are under investigation.

The fungus, Chrysomyxa pirolata Wint. penetrates infected cones and prevents seed development. This rust, which alternates to Pyrola or Moneses to complete its life cycle, was found at 9 of the 36 white spruce areas assessed. The incidence was low, 2% or less of the cones destroyed at most locations, except at Biard, Madawaska County, N.B., where 9% of the cones examined were affected.

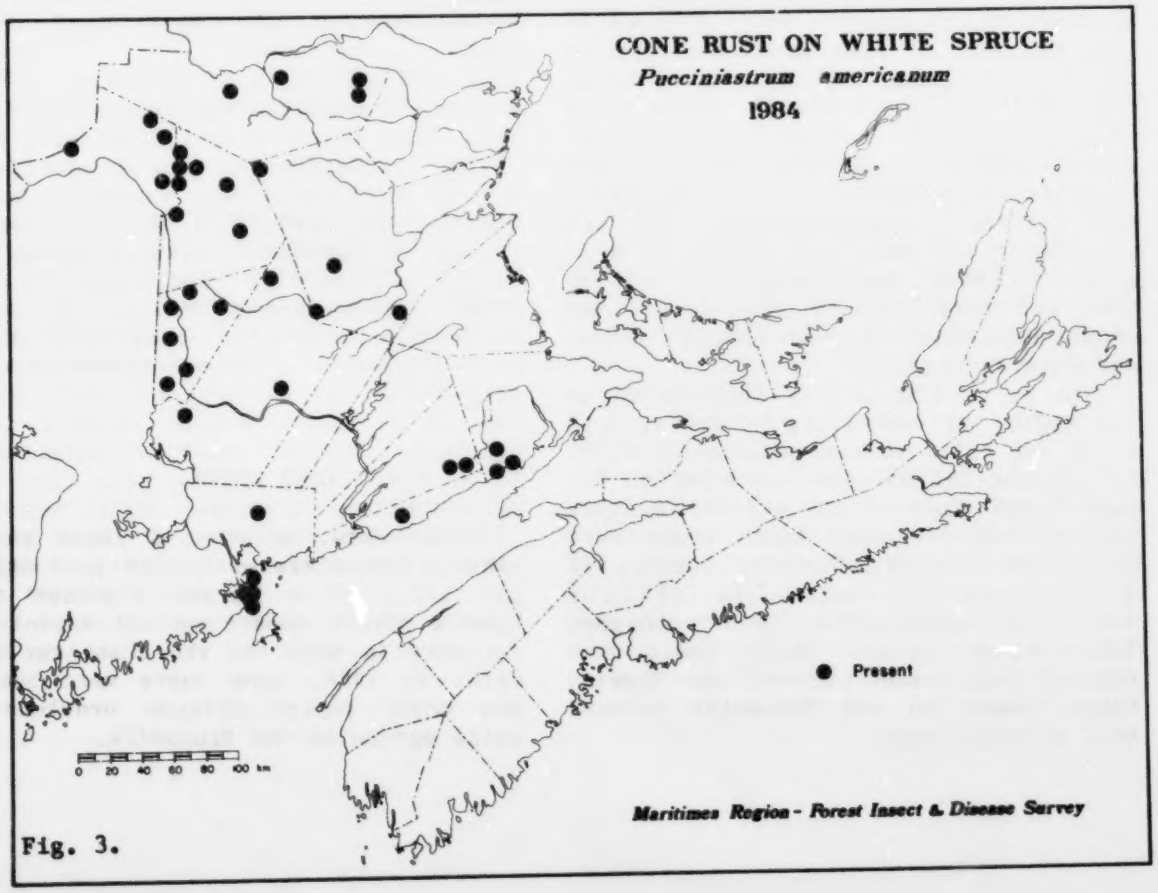

CONE RUST ON WHITE SPRUCE
Pucciniastrum americanum
1984
Present
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 3.

NEEDLE RUSTS

The needles of various conifers are attacked by a group of fungi that need another host, usually a herbaceous plant, to complete their life cycle. The infected needles fall off the tree and, when infection levels are high, damage occurs, such as reduced grade for Christmas trees, growth loss, or in case of repeated severe defoliation, death of young trees in plantations. Because each rust species needs a different alternate host, the proper identification of the fungus is important if control measures are anticipated.

In 1984, weather conditions favored the fungi and needle rusts were common throughout the Maritimes.

On balsam fir, Pucciniastrum epilobii Otth, (alternate host: fireweed), Pucciniastrum goeppertianum (Kuehn.) Kleb. (alternate host: blueberry) and Uredinopsis sp. (alternating to a variety of ferns) all caused needle discoloration and subsequent needle drop. The level of infection was extremely variable among locations and although in many areas less than 5% of the needles were affected, as much as 38% of the needles were lost in a Christmas tree area in Antigonish County and many young natural stands in eastern mainland Nova Scotia appeared yellow from a distance.

On spruce, Chrysomyxa ledi d By. and Chrysomyxa ledicola Lagerh. (alternate host: Labrador tea for both), were present on black, white, and red spruce at a few scattered locations in all areas of Nova Scotia, and Prince Edward Island and in southern New Brunswick. Infection levels were low and did not exceed 5% of the needles infected in any area.

On pine, Coleosporium viburni Arth. (alternate hosts: hobblebush, witherod or highbush cranberry) and Coleosporium asterum (Diet.) Syd. (alternate host: golden rod) occurred on red pine and jack pine. Needle rusts were common in New Brunswick, levels of infection ranged from less than 1% to more than 50% of the needles infected at Nevers Brook, Kent County. Few reports were received from Nova Scotia, however, 72% of the needles were affected in a jack pine plantation in the Chignecto Game Sanctuary, Cumberland County. Infection level was high east of Apple River, Cumberland County in a jack pine plantation and moderate on red pine at East Folly Mountain, Colchester County. Not reported in Prince Edward Island.

On larch, Melampsora medusae Thuem. (alternate host: poplars) was found at several locations in Prince Edward Island. Infection was very low, the highest being at Portage, Prince County where a few needles were affected in 80% of the fascicles.

GYPSY MOTH

After its reappearance in the Maritimes in 1981, the gypsy moth, Lymantria dispar (L.) gained further ground in 1984, and is now at least temporarily established in both New Brunswick and Nova Scotia.

Gypsy moth has been the most destructive insect of hardwoods and to a lesser degree of conifers for decades in the northeastern United States. The status of the outbreak in Maine in the last few years has been a special concern to us because of its proximity to our Region.

The gypsy moth monitoring committee remained active in 1984, and again coordinated all surveys. This committee was formed in response to the discovery of gypsy moth in 1981, in an effort to utilize available manpower more efficiently in combating this latest threat to the forests of the Region. Organizations involved in surveys include the Forest Insect and Disease Survey of the Canadian Forestry Service and Parks Canada of the federal Department of Environment, the Plant Health and Inspection Branch of Agriculture Canada, New Brunswick Department of Natural Resources, New Brunswick Department of Agriculture, Nova Scotia Department of Lands and Forests, Nova Scotia Department of Agriculture, and Prince Edward

Island Department of Energy and Forestry. The New Brunswick Department of Environment was involved in discussions on control. Also, hundreds of volunteers, campground operators, small woodlot owners, biology teachers, students, and other interested private citizens assisted in the extensive pheromone trapping program.

In 1984, early season egg-mass surveys, larval surveys, the 1984 adult trapping program followed by late-fall egg-mass surveys were conducted to reflect the current status of the insect, with the following results.

In New Brunswick the insect was present again at 7 of 10 areas where it occurred in 1983. An egg-mass was found at Burnt Hill, Charlotte County, a new location record. This area, however, is only about 4 km from Mohannes where gypsy moth was first found in the Province in 1981. Larvae, pupae, or fresh egg masses were found in Fredericton, York County and St. Andrews, St. George, St. Stephen, Canoose Road, Oak Hill, Burnt Hill, and the Mohannes area, all in Charlotte County. Numerous egg masses were located with little effort at both St. Andrews and Fredericton. These areas are considered to harbor the two highest local gypsy moth populations in the Province.

In Nova Scotia, gypsy moth was found for the first time in 1984 at Dartmouth, Halifax County, Middleton, Annapolis County, and Weymouth, Digby County. It was present again at Tusket, Yarmouth County, New Minas, Kings County, Halifax, Halifax County, and Shelburne, Shelburne County, and reappeared, after not having been found in 1983 at Clementsport, Annapolis County. There were 59 new egg masses located in the Town of Shelburne, 11 of these on one tree, and in excess of 150 egg masses at New Minas. Gypsy moth must be strongly entrenched in at least these two localities of the Province.

In Prince Edward Island, gypsy moth is not known to occur to date.

The adult male trapping is aimed at defining areas where searching for egg masses should be concentrated. As a

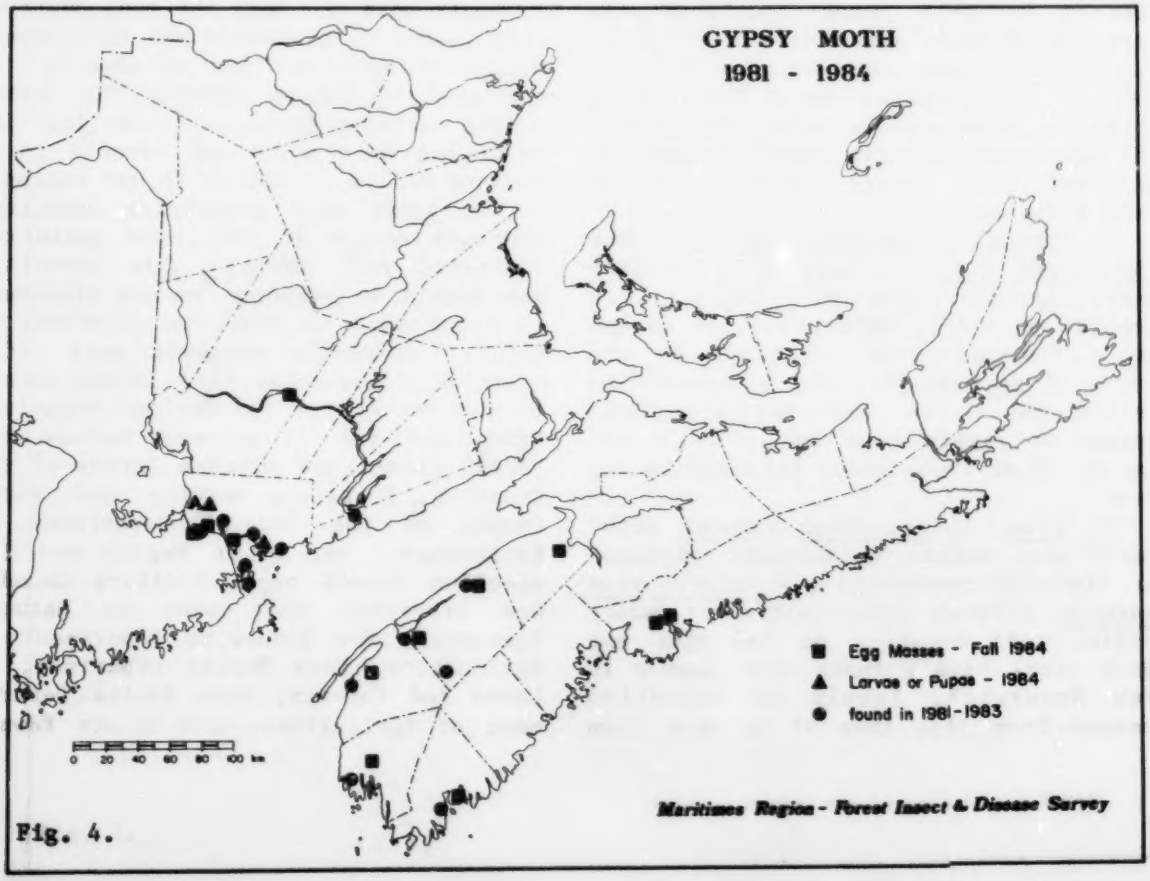

GYPSY MOTH
1981 - 1984
Egg Masses - Fall 1984
Larvae or Pupae - 1984
found in 1981-1983
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 4.

Table 2. Summary of the results of detection surveys for gypsy moth in the Maritimes Region, 1981 - 1984

Province	County	Location	U.T.M. Grid	Gypsy moth life stages											
				1981			1982			1983			1984		
				L	P	E	L	P	E	L	P	E	L	P	E
New Brunswick	Charlotte	Mohannes	19-62(7)-500(2)	x			x	x	x	x	x		x	x	x
		N.W. of Oak Hill (Canoose Rd)	19-62(9)-502(3)									x	x		
		Oak Hill	19-63(1)-502(2)				x			x			x		
		Upper Mills	19-63(2)-500(0)							x					
		Lynnfield	19-63(3)-502(7)				x								
		St. Stephen	19-63(7)-500(4)						x	x			x	x	x
		Oak Bay area	19-64(0)-501(1)							x					
		St. Andrews	19-65(4)-499(3)							x	x	x	x	x	x
		Didgequash	19-66(2)-500(2)				x								
		St. George	19-67(2)-499(9)					x		x	x	x	x		
		Beaver Harbour	19-67(7)-499(4)	x						x					
		Pennfield	19-68(9)-499(4)	x											
		Campobello Island	19-66(0)-497(2)					x							
		Grand Manan Island	19-67(3)-494(9)	x											
		Burnt Hill	19-63(0)-500(4)												x
	St. John	Saint John	19-72(9)-501(5)					x							
	York	Fredericton	19-68(3)-509(3)						x			x	x	x	x
Nova Scotia	Yarmouth	Yarmouth	20-24(9)-485(8)	x					x		x				
		Tusket	20-26(2)-486(0)									x		x	x
	Digby	Grosses Coques	20-25(3)-491(6)					x	x	x					
		Digby	20-28(2)-494(4)									x			
		Smiths Cove	20-28(4)-494(3)					x	x						
		Weymouth	20-26(2)-492(2)											x	x
	Annapolis	Clementsport	20-29(4)-494(8)					x	x						x
		Paradise	20-32(6)-497(2)						x	x					
		Kejimkujik Nat. Park	20-31(9)-492(5)							x	x				
		Middleton	20-33(6)-497(2)										x		
	Kings	New Minas	20-38(6)-499(2)							x	x	x	x	x	x
	Halifax	Halifax	20-45(5)-494(3)							x		x	x		x
		Dartmouth	20-45(6)-494(6)												x
	Shelburne	Shelburne	20-31(4)-484(8)						x			x			x
		Clyde River	20-30(0)-483(4)						x						

U.T.M. = Universal Transverse Mercator system.
L = larva; P = pupa; E = egg mass.

result of studies since 1980, the trap placement design was changed to eliminate, or at least to minimize, interference from large numbers of male moths (females are flightless) brought into the Region by weather fronts from infested areas in the United States. The same system was used again in 1984. Information was obtained from 2072 traps, 985 in New Brunswick, 885 in Nova Scotia, and 202 in Prince Edward Island. Better understanding by cooperators of the value of negative results greatly aided the planning of the fall egg-mass surveys. Although the number of positive traps or of moths captured should not be taken in isolation, the following is offered to demonstrate the point. While 28% of the traps in Nova Scotia were positive, i.e., captured at least one gypsy moth male, 48% of the traps were positive in western Nova Scotia where the gypsy moth is known to occur, but only 6% were positive in the eastern part of the Province where it is not. Further, the average number of moths in positive traps was almost fourfold in the west compared with the number in eastern Nova Scotia. The differences were even more pronounced in New Brunswick between infested Charlotte County and the noninfested northern counties. There were no moths captured in any of the 202 traps in Prince Edward Island in 1984.

The results of gypsy moth surveys, other than adult trapping programs, conducted from 1981 to 1984 are summarized in Table 2 and Fig. 4. Gypsy moth appears well entrenched in southwestern New Brunswick and in western Nova Scotia, however, the populations at present, in most places, are low.

Control operations against the gypsy moth in 1984 were localized and sporadic and no reliable information is available. Several communities (Fredericton, St. Andrews, Digby) became involved in public awareness programs emphasizing citizen participation in combatting this newly arrived pest.

FOREST TENT CATERPILLAR

The Forest Tent Caterpillar, Malacosoma disstria Hbn., was still the major defoliator of hardwoods in the Maritimes, in spite of the fact that the total number of infested areas decreased drastically in 1984 from previous years, in both New Brunswick and Prince Edward Island and increased only slightly in Nova Scotia (Table 3).

Table 3. Forest tent caterpillar out breaks in the Maritimes Region (1978-1984)

Year	Area of severe/moderate defoliation (ha)		
	N.B.	N.S.	P.E.I.
1978	few small patches	----	5 000
1979	37 000	----	5 000
1980	177 000	trace	3 100
1981	775 000	small patches	13 800
1982	1 389 000	4 700	18 800
1983	1 119 000	35 000	67 000
1984	94 400	46 400	37 400

The insect feeds on a wide variety of hardwood trees with preference for trembling aspen, oak, apple, birch, and cherry. When populations are high and larvae migrate in search of food, other tree species such as sugar maple, ash, alder, elm, and ground vegetation are also readily defoliated. Feeding also occurs on some conifers, notably larch and white spruce.

In New Brunswick, severe defoliation, mostly of poplars, occurred over 90 500 ha in 1984. Defoliation was moderate over 3 900 ha. The 94 400 ha of severe and moderate defoliation represents less than 8% of the 1 199 000 ha affected a year earlier. All defoliation occurred in the eastern part of the Province, in six distinct areas and in several smaller patches in Northumberland, Kent, and Westmorland counties (Fig. 5).

A lessening of the outbreak, following a population decline was expected but the drastic reduction was far greater than anticipated for 1984.

The outbreak has been shifting to the southeast since it first started in the Woodstock, Carleton County, area in 1979. There has been a build-up of disease, parasites, and predators such as the Sarcophaga flesh fly; there was mass starvation of larvae at the height of the outbreak at many locations which resulted in fewer egg masses laid. All of these are factors in weakening the forest tent caterpillar population. In addition, there were two consecutive years when the early summer was cool and precipitation was much above normal. A weakened forest tent caterpillar population combined with weather conditions unfavorable to its survival probably hastened the almost total collapse of the New Brunswick outbreak earlier than anticipated.

In Nova Scotia, forest tent caterpillar caused 44 100 ha of severe, and 2 300 ha of moderate defoliation in 1984, an 11 400 ha increase from last year in the area of the outbreak. Most of the defoliation occurred in Annapolis, Kings, and Hants counties but the insect also affected trees in numerous patches in northern Cumberland County. In the Annapolis Valley, poplars, birch, and even alder were completely stripped of foliage in some areas. Although the insect was present in many other parts of the Province, the highest populations were found in western Nova Scotia.

In Prince Edward Island, the long-standing forest tent caterpillar outbreak continued in 1984. Defoliation of trembling aspen was severe over 22 400 ha and moderate or severe over 15 000 ha in western Prince County. The area affected was essentially the same as in 1983 (Fig. 5). However, the level of

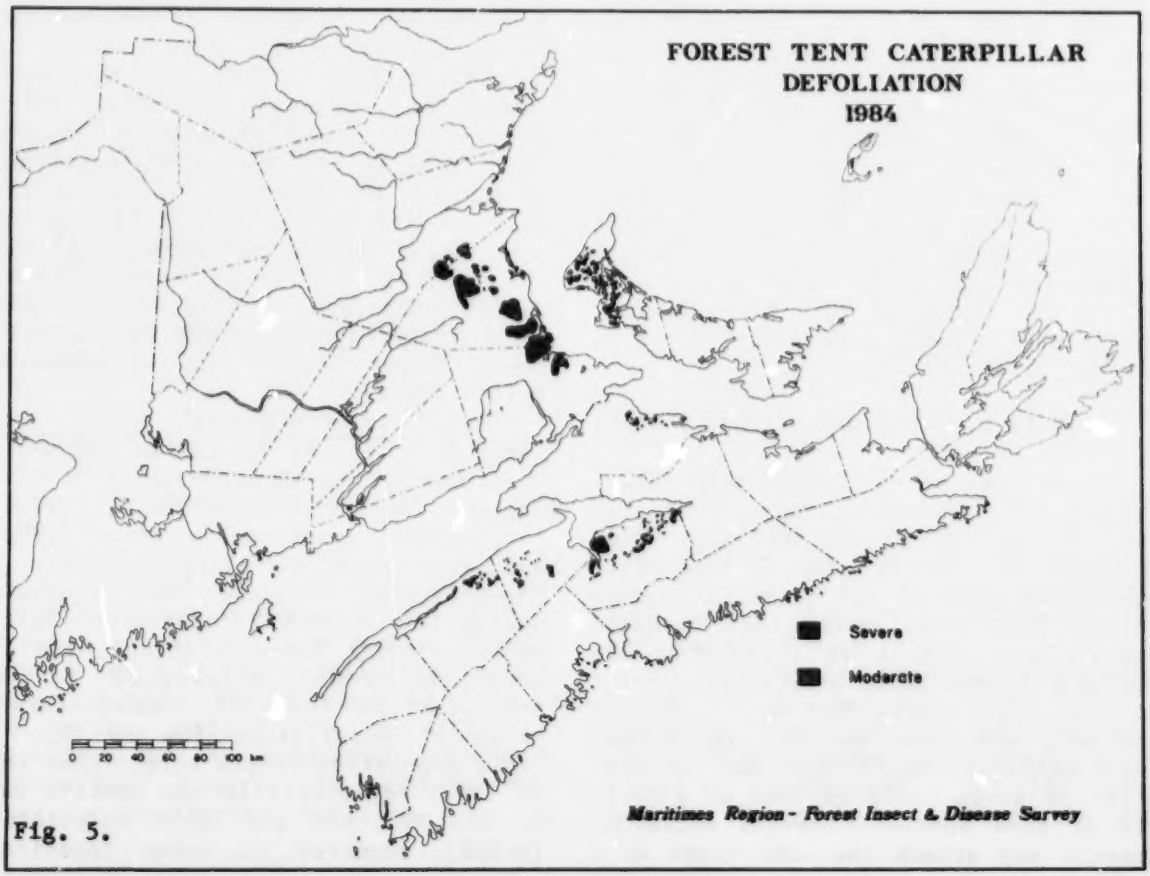


Fig. 5.

defoliation increased in the northwestern parts and decreased in the southeast where fewer stands were defoliated to a lesser degree than in 1983.

Repeated severe defoliation results in twig and branch mortality. A survey to determine the condition of aspen showed that stands with the highest degree of deterioration are in Carleton County, New Brunswick and in western Prince County, Prince Edward Island, the two areas of the Maritimes with the greatest number of successive years of severe defoliation by forest tent caterpillar.

In areas where defoliation is not complete, the forest tent caterpillar uses the remaining leaves as pupation sites. These sites, in turn, are invaded by secondary insects that then feed on the remaining foliage. A survey in 1984 showed that the most common of these, the aspen webworm, Tetralopha aplastella (Hlst.) and the lesser aspen webworm, Meroptera pravella (Grt.), were present in all three provinces in the forest tent caterpillar outbreak areas where defoliation occurred in previous years. The relative ratios of the two insects were variable, as were the levels of affected leaves. The highest incidence was recorded near Springhill, Prince County, P.E.I. where 77% of the leaves remaining after the forest tent caterpillar feeding period were brown as a result of activity by the webworms. These insects may put an extra stress on already affected trees.

OTHER HARDWOOD DEFOLIATORS

In addition to the forest tent caterpillar, which caused widespread defoliation in the Region, and the gypsy moth, which is of special concern because of its recent arrival and potential damage in the Maritimes, many other hardwood insects were active in 1983. Most are included in the table because they occur in localized areas. However, a few of the more prevalent species are discussed. Hardwood defoliators may be specific to given hosts or feed on a variety of tree species. Several different insects may attack the same trees at a specific location, and often it is difficult, and impractical to allocate portions of the total defoliation to the various foliage feeders.

Fall Cankerworm, Alsophila pometaria (Harr.) was the most widely reported hardwood insect in the Region for the second consecutive year in 1984. It occurred throughout the Maritimes, with the exception of Cape Breton Island, alone or in combination with other defoliators. A great variety of hardwood species were affected both in forest stands and in populated areas but Manitoba maple was particularly hard hit wherever it was present. In New Brunswick, defoliation was severe near Gaspereau Forks (200 ha), Queens County, Ripples (100 ha) and Blissville (50 ha), Sunbury County, McNairn (50 ha), Kent County, at Fredericton, York County, from there to Jemseg, Queens County along the Trans-Canada Highway, at Pine Glen Road, Albert County, at scattered locations along the Trans-Canada Highway from Moncton to Sackville, Westmorland County and along the highway from Coles Island, Queens County to Salisbury, Westmorland County. In Nova Scotia, various levels of defoliation resulted from feeding by the fall cankerworm throughout the mainland. In the eastern part of the Province, defoliation was most often caused in combination with the winter moth. In Prince Edward Island, moderate to severe defoliation of Manitoba maple occurred in Charlottetown, Queens County, and at Rosebank, Prince County.

Lesser Maple Spanworm, Itame pustularia Gn., is a defoliator of red maple. This insect, in combination with other foliage feeders and the maple leafroller, caused considerable crown dieback and some tree mortality in parts of Northumberland County New Brunswick during the 1972-1975 infestation. After years of very low populations, the insect was found widespread in New Brunswick in 1983 but caused only a trace of defoliation (up to 5%). In 1984, population levels were higher than in 1983, especially in the eastern part of the Province and light defoliation (6-29%) occurred at many locations.

Light-trap records from Ashton Hill, Northumberland County, the area of the last outbreak, show the following catches of lesser maple spanworm:

1978	27
1979	44
1980	157
1981	723
1982	1009
1983	9926
1984	32597

In 1972, the first year of the 1972-1975 outbreak, there were 12 455 lesser maple spanworm adults captured at the Ashton Hill trap. The populations remained low in both Nova Scotia and Prince Edward Island.

Oak Leaf Shredder, Croesia semipurpurana (Kft.) and the Oak Leafroller, Pseudexentera cressoniana Clem., have been defoliating oak since the early 1970s and have been the most serious pests of oak in the Maritimes. As a result of repeated defoliation, oak trees in many areas are suffering from various degrees of twig, branch, and crown dieback.

In 1984, the general decline in the populations of these insects reported in 1983 continued, but light defoliation was still widespread in western Nova Scotia. Moderate defoliation was reported at Grafton Lake, Queens County, Nova Scotia and near Milton Station, Queens County, Prince Edward Island, moderate to severe defoliation occurred at Nerepis, Kings County, New Brunswick and a few trees were completely defoliated at Renous, Northumberland County, New Brunswick. Dead twigs and branches are common on the trees at the damage assessment plots (and elsewhere) in both Nova Scotia and New Brunswick, the result of repeated defoliation by these insects.

Winter Moth, Operophtera brumata (L.), populations mixed with fall cankerworm caused increased hardwood defoliation in eastern Nova Scotia in 1984. Severe or moderate defoliation, mostly of wild apple trees, occurred in east Colchester, north Pictou, and Antigonish counties and at scattered points in Guysborough County. In western Nova Scotia, populations declined from the 1983 levels and moderate defoliation was observed only on apple trees in Brooklyn and Falmouth, Hants County and on a variety of ornamental trees in Lunenburg and Yarmouth counties. Winter moth populations were low in Prince Edward Island. The insect was not found in New Brunswick.

Bruce Spanworm, Operophtera bruceata (Hulst) has existed at generally low population levels in the Maritimes since 1976 when the last outbreak collapsed in Nova Scotia. There was a slight population increase in northwestern New Brunswick in 1982 and 1983. In 1984, the insect was present throughout New Brunswick in a variety of hardwood trees but generally at very low populations, including much of the northwestern part of the Province. Defoliation was usually less than 5% and was observed at higher levels only at a few locations, including Tay Valley, York County, at 34%. Populations were very low in Nova Scotia and the insect was not observed in Prince Edward Island.

DUTCH ELM DISEASE

Dutch Elm Disease, caused by the fungus Ceratocystis ulmi (Buism.) Moreau, did not spread significantly in the Region in 1984 as most new locations were from inside or on the peripheries of the known distribution (Fig. 6). The only exception was Berwick, Kings County, Nova Scotia and the discovery of the disease there has closed the gap between the two infected areas in the Annapolis Valley. However, the disease intensified greatly in many areas within the known range, indicated by newly infected, dying trees.

In New Brunswick, there was a resurgence of infection on small trees in the Fredericton area and was observed along the Keswick River as far as Zealand, York County. Some of the infected trees were only 1.5 m in height.

In Nova Scotia, in Antigonish County, where the disease was first found in 1981, in excess of 100 dead and dying trees were counted just north of the Town of Antigonish, in 1984. Near Newport, Hants County, 11% of the trees

became infected between 1980 and 1982, infection rate increased significantly to 55% in 1983 and to 69% in 1984. This pattern agrees closely with that found in other parts of the Maritimes and indicates that most elm trees will become infected within a few years in this area. The disease also intensified in other outbreak areas where no sanitation is practiced.

In Prince Edward Island, no infected elm trees were found in 1984. The disease was first discovered in 1979 in Prince County. This discovery was followed by an immediate, vigorous sanitation cut by the provincial government. No infected trees were found in 1980 and 1981, one infected tree was identified and removed in 1982, and there were none found in 1983.

In Fredericton, where the progress of Dutch elm disease and the effect of the control program have been monitored since 1961 when the disease was first found in the City, there was a further reduction in the annual loss of trees in 1984. The 35 trees killed by the disease represented 1.1% of the current elm tree population within the Dutch Elm Disease Management Area. This is the fourth consecutive decrease in the annual loss rate since 1980 when it reached a peak of 7.8%, followed by 5.3% in 1981, 3.0% in 1982, and 2.4% in 1983. Losses to date amount to 27.0% of the original urban elm stand.

No systematic survey was conducted by the Forest Insect and Disease Survey in 1983 for elm bark beetles, the carriers of Dutch elm disease, except in Fredericton, where populations of the native elm bark beetle, Hylurgopinus rufipes (Eich.) remained low.

DETERIORATION OF WHITE BIRCH ALONG THE BAY OF FUNDY

Since 1979, early leaf browning and premature leaf drop of white birch occurred annually in southern New

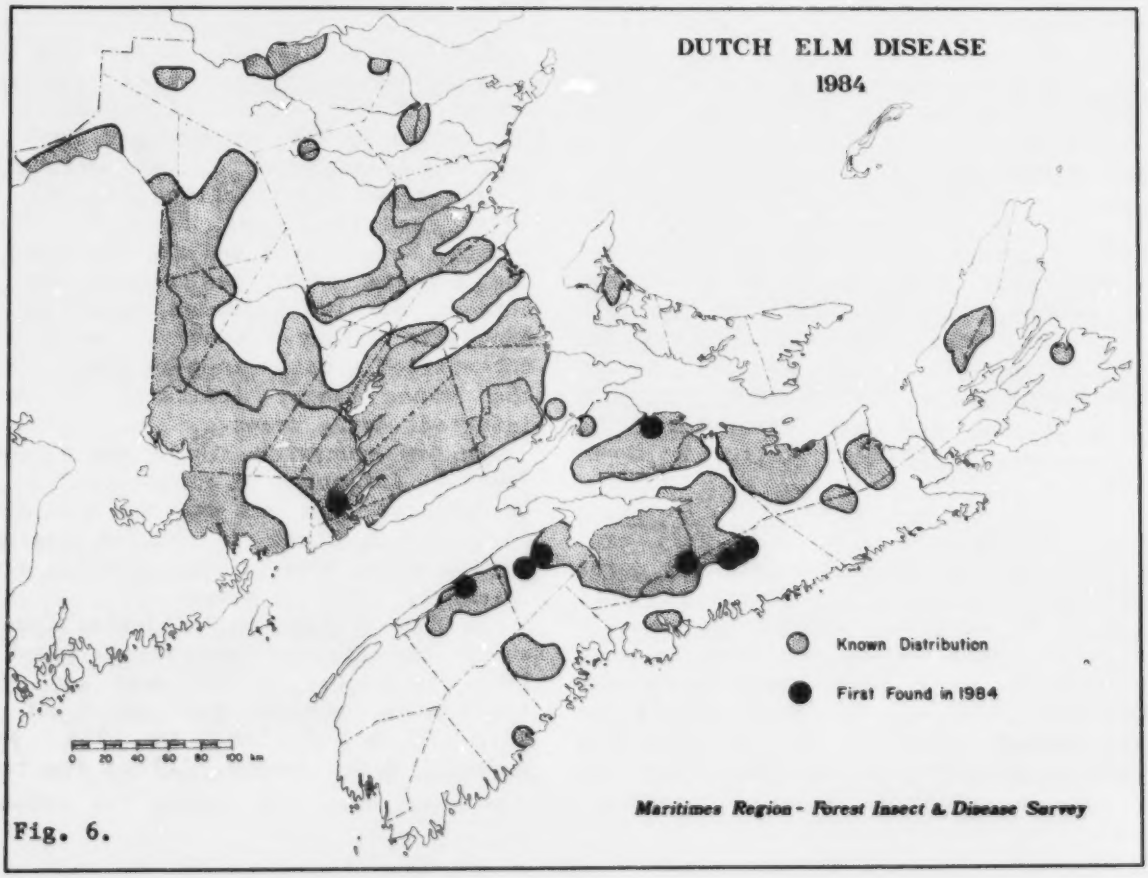

DUTCH ELM DISEASE
1984
Known Distribution
First Found in 1984
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 6.

Brunswick and, in some years, in western Cumberland County along the Bay of Fundy (Fig. 7). Browning, severe every year with the exception of 1982, develops quickly and is characterized by chocolate-brown discoloration and a scorch-like appearance, which at times is restricted to leaf margins. The affected leaves curl and start dropping as early as mid-August. It was observed that some leaves that developed in the latter part of the season remained green while older leaves on the same twig turned brown. Although mainly a condition of white birch, similar symptoms were observed on other deciduous vegetation including alder, mountain ash, and mountain maple, in 1980 and 1981. The condition occurs along a coastal strip of 1 to 15 km wide and extends inland as far as 30 km, mainly along low lying areas.

White birch is in very poor condition in some of this area. The foliage is thin even before the early browning appears, crown dieback with dead twigs and branches is evident and many trees die. The cause of foliage discoloration and deterioration of white birch remains unknown. Several organisms are associated with this condition but none of them, alone or in combination, satisfactorily explains the situation.

A leaf spot fungus, Septoria betulina (Lib.) West., has been consistently present on the affected trees and in 1982, when the condition was least severe, accounted for much of the leaf browning. This fungus is known to have caused severe browning elsewhere in the past but not on such a large scale and not for such an extended period of time. Its association with the condition is an inescapable fact. However, where the fungus is present on white birch in other parts of the Maritimes, the symptom expression is different from that found along the Bay of Fundy. Further, S. betulina does not account for the leaf browning observed on other vegetation.

Bronze Birch Borer, Agrilus anxius Gory, has been active in the area and was implicated in the death of many trees. The insect attacks weakened trees only and therefore cannot be considered a primary factor. However, the preponderance of infested locations in a band roughly parallel to the Bay of Fundy (see Cyclical Review) serves as an indication of where in the Maritimes white birch is in a deteriorating condition.

Birch Ambrosia Beetle, Trypodendron betulae Sw. another insect normally considered secondary has a wider distribution (see Cyclical review) than the bronze birch borer but the pattern of occurrence is essentially the same for both insects. Another indicator of unhealthy white birch.

Birch Scale, Xylococculus betulae (Perg.) was found infesting an average of 95% of the trees (range 60 to 100%) on 11 plots examined in southern New Brunswick in 1984. This compares with an average of 34% of the same trees (range 0 to 88%) infested in 1983. The impact the insect may have on the trees and the reason for this sudden increase is unknown (it is not a sampling problem).

Other Factors must act as predisposing agents since the organisms mentioned provide only proof that white birch is in a weakened condition.

Abiotic factors such as drought, past and present logging operations, road salting along highways and in urban areas, ocean salt spray in coastal regions including the 1976 "ground hog day storm", global climatic changes, and increased emissions from automobiles and from industrial sources, both near and far, have all been advanced as possible explanations for forest damage. Some of these do not apply to the Bay of Fundy area. Others and some additional factors may apply but proving those interactions is beyond the current mandate and capabilities of the Forest Insect and Disease Survey.

We do not often engage in speculation in our annual report on forest pest conditions. However, because concerns have been expressed regarding this condition of "unknown cause" which occurs repeatedly in the same area and because

it is damaging a part of the forest (definitely a Forest Insect and Disease Survey mandate), we offer the following for consideration:

1. The area affected is one of two in the Region with high emissions of SO_2.
2. The area closely coincides with the 30 kg/ha per year wet acid sulphate deposition zone (1981 CANSAP data) which at that level is the highest concentration and the only area affected in the Maritimes.
3. Circumstantial evidence indicates that gypsy moth males are carried into the Maritimes by storm fronts from outbreak areas in industrial United States. In 1981, the area of leaf browning was similar to the area of the highest incidence of in-blown gypsy moth adults. Storms are also implicated in the long-range transportation of industrial impurities.
4. The affected area roughly coincides with that of the famous "Fundy fog."
5. Air pollutants were ruled out as the cause of leaf discoloration, based on foliage and soil sample analysis in 1982 - which was the year of least severity.

In 1984, severe leaf browning and premature defoliation occurred again in the same areas affected in previous years. In addition to the Bay of Fundy area, discoloration of birch also occurred elsewhere, notably in eastern Nova Scotia and northcentral New Brunswick. The main difference in symptom expression was the lack of scorching and leaf curling in most of the other areas.

CHRISTMAS TREE PESTS

Among the many pests of balsam fir Christmas trees, the spruce budworm is by far the most significant in most

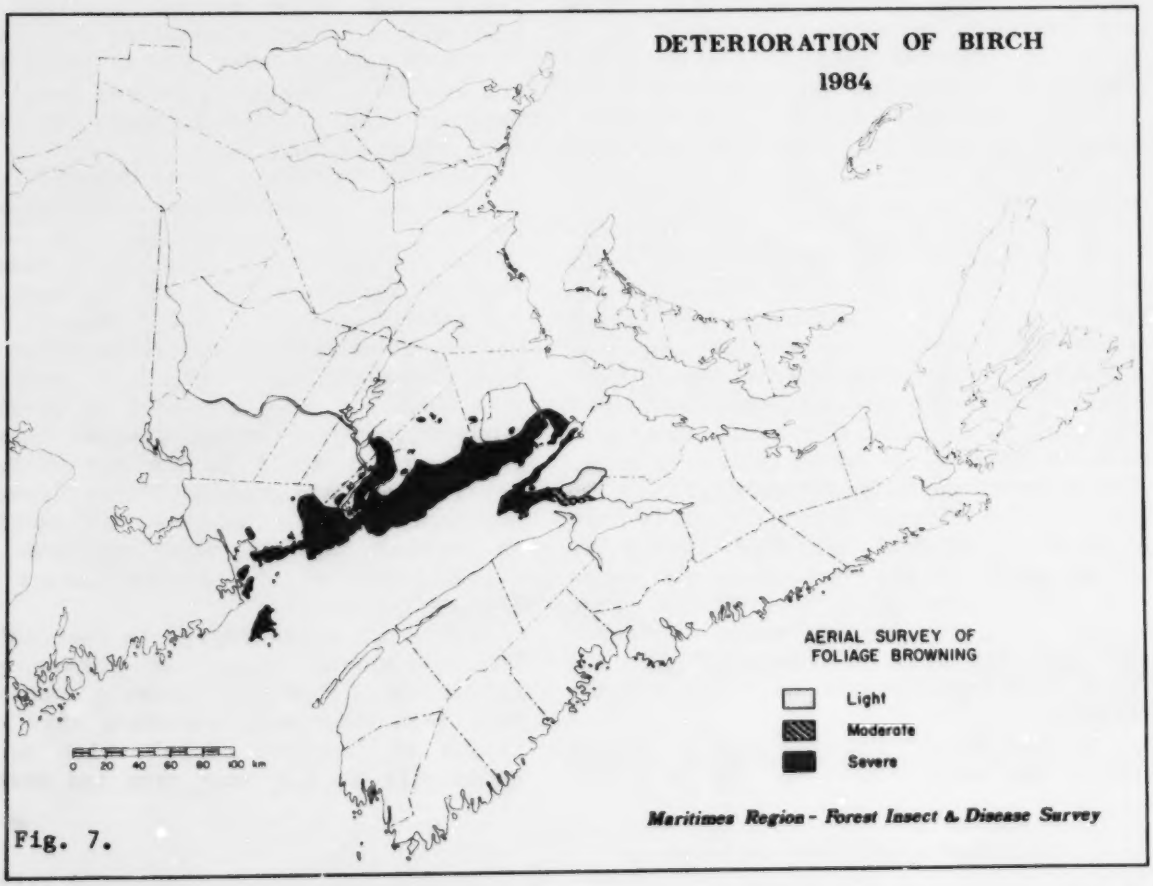


Fig. 7.

areas of the Maritimes. Some of the others, usually only of localized importance are mentioned elsewhere in this report. Two insects, however, are discussed here because of their widespread occurrence and because of their effect on the quality and consequently on the value of Christmas trees. They are discussed not strictly from the point of Christmas tree production, but because their presence in natural stands has a spill-over effect, the statements are relevant.

Balsam Gall Midge, Paradiplosis tumifex Gagne, was widespread again in the Region in 1984. Infestation levels were extremely variable in both natural stands and in Christmas tree plantations. Because of the importance of this insect on the quality of Christmas trees several types of surveys were conducted in 1984 to determine infestation levels.

In Nova Scotia, the highest infestation level was recorded near Colpton, Lunenburg County where 60% of the needles were affected. Counts in nine Christmas tree plantations in Lunenburg, Kings, Halifax, Guysborough, and Antigonish counties indicated an average infestation level of 2.6% on the trees, the highest recorded at East Ship Harbour, Halifax County, at 5.3%. A survey conducted by personnel of the Nova Scotia Department of Lands and Forests at 69 locations in Christmas tree plantations, cultivated and natural stands, sprayed or unsprayed against the insect, in Yarmouth, Annapolis, Kings, Cumberland, Colchester, Halifax, and Guysborough counties showed that an average of 3.4% needles per tree were infested by balsam gall midge. The insect was present in 74% of the areas. The highest incidence was recorded in a young natural stand cultivated for Christmas trees in Halifax County, where 38.8% needles per tree were affected.

In New Brunswick, the insect was widespread but occurred generally at low levels in both Christmas tree plantations and natural stands. The level of infestation by the balsam gall midge was determined during the spruce budworm egg-mass surveys by the New Brunswick Department of Natural Resources. The insect was present mostly in the west-central and the southern parts of the Province but was found in only 23.6% of the over 500 UTM grids sampled. The highest infestations affected only slightly more than 20% of the needles. These were found at a few locations in eastern Carleton and southeastern Victoria counties but represented only 2.5% of the 119 positive locations in the Province. Less than 10% of the needles had galls in 89% of the positive areas. Although the above represents samples from larger trees used to determine spruce budworm populations they are comparable to results obtained from Christmas tree plantations and are a good indication of the distribution of balsam gall midge populations in the Province in 1984.

In Prince Edward Island, the insect was present at all 12 locations surveyed, 4 in each county, but the population levels were very low. The highest infestation was recorded at New Zealand, Kings County where 17% of the needles were affected on about 40% of the trees on understory regeneration.

Balsam Twig Aphid, Mindarus abietinus Koch, was present throughout much of the Region but, except for spots of high infestation, the anticipated general outbreak did not materialize in 1984.

In New Brunswick, the presence or absence of balsam twig aphid was noted by the New Brunswick Department of Natural Resources during spruce budworm egg-mass surveys. Almost 82% of the samples with balsam twig aphid were collected in the northern half of the Province, where the aphid was present in 51% of the over 300 UTM grids sampled. The distribution was general with the exception of a strip along the eastern coastline. In the south, only 16.4% of the over 200 UTM grids sampled were positive and most of these originated from the southwestern corner of the Province. Our surveys showed that although the level of infestation was generally low in New Brunswick, considerable variation occurred between areas. Infestations were highest in the northwest with the following average numbers of branches infested: Victoria and

Restigouche counties 18%, Madawaska County 32%. The highest single count of 78% of the branches affected was recorded near the Caribou Brook, Madawaska County.

In Nova Scotia, balsam twig aphid affected an average of 6.6% of balsam fir branches in Christmas tree plantations, cultivated and wild natural regeneration, and older natural stands at the 105 locations examined in 1984. Most of the affected areas were in western Nova Scotia and in Guysborough County. Moderate branch damage (over 30% of branches infested) was observed at only 6 of the 105 locations, the highest infestation level (47%) recorded in a stand cultivated for Christmas trees in the Lake George area in Yarmouth County.

In Prince Edward Island, balsam twig aphid populations were very low in 1984.

NURSERY AND GREENHOUSE PROBLEMS

Successful seedling production is essential to avoid or at least to minimize the shortfalls in wood production predicted to occur in the future. Seedling production is as important to plantation programs as seed production is to nurseries. Pests affecting nursery production increase the costs of meeting the objectives of forestry.

Some of the conditions encountered in 1984 in nurseries and greenhouses are mentioned because of their importance and to demonstrate that no facet of forestry is without problems. The following, which is not intended to be all inclusive, was gathered with the cooperation of R.D. Hallett and T.W. Burns, (MFRC.)

Insects: Otiorhynchus sulcatus (F.) the black vine weevil, a root feeding insect, damaged black spruce and red spruce seedlings in two Nova Scotia nurseries; Oligonychus ununguis (Jac.) the spruce spider mite affected spruce seedlings in two New Brunswick nurseries, causing the death of 5% of grafted trees in one; Polia sp., a climbing cutworm, was found on larch seedlings in New Brunswick; Tipula sp., a moisture loving crane fly, which normally feeds on decaying organic material but is capable of damaging roots, affected potted root stock in New Brunswick.

Fungi: Armillaria mellea (Vahl ex Fr.) Kummer infected a few trees in a seed orchard in southern New Brunswick; Botrytis cinerea Pers. ex Fr., a fungus favored by high humidity as a result of dense conditions, affected various tree species in numerous nurseries in the Region, requiring treatment; Cronartium ribicola J.C. Fischer, the white pine blister rust, infected seedlings in a nursery in Nova Scotia and required severe culling of the stock, the first time in many years that this fungus occurred as a nursery problem; Lophodermium pinastri (Schrad. ex Fr.) Chev. (= L. sedi:iosum) a needle cast, affected red pine in Prince Edward island, Sirococcus strobilinus Preuss remained a continuing concern on spruce seedlings in Nova Scotia.

Abiotic conditions: Freezing, winter drying, salts, overwintering storage and handling problems were among the most commonly listed conditions that affected seedlings. Being "affected" ranged from seedlings dying, in some cases large numbers of them, to seedlings with poorly developed root systems or yellow, sickly-looking shoots or needles. In either case, culling is necessary or, if inferior seedlings are planted, they will have a less than fair chance to develop as they should in the plantations.

SPECIAL SURVEYS

SPECIAL SURVEYS

Several forestry projects are carried out each year that are not necessarily related to one of the forest pests of major importance. In the past, information from these projects has either been reported elsewhere or used internally. Considering the implications this information may have in forest management, it is summarized and the results of special surveys will be included in this and future annual reports.

ACID RAIN NATIONAL EARLY WARNING SYSTEM

Acid rain has been a global concern for the past few years and the effects of impurities in the air, on lakes, buildings, and the forest are becoming more apparent in many parts of the world.

Acid rain means more than just rain with lower than normal pH, falling from clouds that come from elsewhere. It includes any form of acid precipitation, both wet and dry, includes air pollutants of different kinds from both near and far if they, alone or in combination, directly or indirectly affect or may affect the health of Canada's forests, interfere with their normal development, the production of wood, or with their role in providing a healthy environment.

Concern over the future of the Canadian forests has intensified as a result of the alarming tree mortality observed in other parts of the world. The Acid Rain National Early Warning System (ARNEWS) came into being in the early part of 1984 when the Canadian Forestry Service was instructed to establish a national program to detect, clearly and accurately, early signs of acid rain damage to Canada's forests before damage becomes obvious.

The objectives of the program are

1. To detect the possible damage to forest trees and soils caused by acid rain or to identify the damages sustained by Canadian forests (trees and soils) which are not attributable to natural causes or management practices;

2. Long-term monitoring of vegetation and soils to detect future changes attributable to acid deposition and other air pollutants in representative forest ecosystems.

The Forest Insect and Disease Survey was charged with the responsibility for (1) plot establishment, (2) above-ground parameter monitoring and sampling, (3) providing assistance in obtaining foliage and soil samples for chemical analysis.

Permanent plots are to be maintained in all Regions of Canada to monitor:

a. the condition and changes in the condition of the forest stand,
b. the presence and fluctuation of biotic and abiotic factors that affect the condition of the forest (insects, diseases, stand changes, temperature, etc.),
c. the changes and symptoms that indicate factors not attributable to the above that could conceivably be early signs of acid rain damage, and
d. effect of acid rain on the condition of the various economically important tree species.

The rationale behind the above is that without close monitoring of all of the factors mentioned, the expected, initially subtle, effects of acid rain cannot be isolated and identified.

In the Maritimes Region, 15 permanent ARNEWS plots, representing the important forest species and geographical areas, were established in 1984 (Fig. 8). Some of the baseline information characterizing the areas is listed in Table 4.

In addition to the work on permanent plots, the results of observations for signs of possible acid rain damage were recorded for most of the 278 locations where detailed pest condition assessments were made. Special attention was directed to the number of years of needle retention on coniferous species. Forest Insect and Disease Survey personnel are always on the lookout for the unusual or unexplained forest conditions, some of these conceivably suspect for acid rain damage.

Table 4. Acid Rain National Early Warning System. Some baseline characteristics of ARNEWS plots in the Maritimes established in 1984

ARNEWS Plot No.	Plot Location[1]	Number of trees on plot		Species composition[2]	All trees (ave.)		Live crown (ave.)	
		Living	Dead	%	Diameter[3] cm	Height m	Width m	Length m
201	Acadia For. Exp. Station Sunbury Co., N.B. 19-70(90)-510(0)	56	1	63 - bS 29 - rM 8 - wB	16.5	14.3	2.8	7.9
202	Mount Carleton Northumberland Co., N.B. 19-65(6)-524(7)	38	3	82 - bF 10 - wB 5 - wS 3 - yB	18.8	12.8	3.1	6.8
203	Halfway Madawaska Co., N.B. 19-55(2)-527(4)	35	1	86 - sM 14 - yB	17.2	14.4	4.3	10.3
204	Acadiaville Kent Co., N.B. 20-33(7)-517(8)	60	8	90 - jP 10 - bS	15.8	14.8	2.1	5.6
205	South Dungarvon River Northumberland Co., N.B. 19-67(8)-518(8)	40	12	90 - rS 7.5 - bF 2.5 - wB	17.8	13.0	2.7	7.1
206	Martin Head St. John Co., N.B. 20-32(8)-504(9)	54	1	69 - wB 24 - rS 3.5 - rM 3.5 - yB	14.7	11.6	3.2	6.2
207	Lepreau Falls St. John Co., N.B. 19-70(0)-500(4)	46	9	56.5 - tL 32.5 - bS 11 - bF	17.5	12.5	3.5	8.4
208	Goose River Kings Co., P.E.I. 20-53(8)-514(3)	66	1	58 - S 23 - tA 9 - bF 7 - wS 1.5 - wiB 1.5 - bCh	13.2	9.6	2.3	5.4
209	Chignecto Game Sanctuary Cumberland Co., N.S. 20-39(6)-504(8)	60	2	93 - rS 3 - rM 2 - bF 2 - wB	16.8	12.1	2.6	6.5

Table 4. Continued

ARNEWS Plot No.	Plot Location	Number of trees on plot		Species composition	All trees (ave.)		Live crown (ave.)	
		Living	Dead	%	Diameter cm	Height M	Width M	Length M
210	Hemlock Hill Queens Co., N.S. 20-33(0)-490(5)	53	1	38 - rS 30 - bF 15 - wP 7.5 - wB 5.5 - As 4 - rM	16.4	12.2	3.5	7.5
211	Rossignol Lake Queens Co., N.S. 20-32(7)-490(5)	29	0	100 - wP	20.0	13.6	4.3	8.3
212	Whycocomagh Inverness Co., N.S. 20-64(6)-509(2)	51	12	43 - bF 25.5 - wB 21.5 - wS 10 - rM	13.9	9.9	2.6	6.6
213	Frankville Guysborough Co., N.S. 20-61(2)-505(5)	75	11	57 - bF 25 - wS 11 - rM 4 - eH 3 - yB	14.4	11.8	2.2	4.9
214	Middle Musquodoboit Halifax Co., N.S. 20-48(6)-498(9)	71	0	48 - bF 41 - rM 7 - wS 3 - ltA 1 - rS	13.0	11.8	3.1	6.2
215	Blomidon Prov. Park Kings Co., N.S. 20-39(4)-501(3)	52	0	48 - wS 33 - bF 19 - rS	17.8	10.5	3.5	7.3

Includes U.T.M. grid to nearest kilometre.
Percent based on total living trees on plot; standard FIDS tree abbreviation.
Diameter measured at breast height.

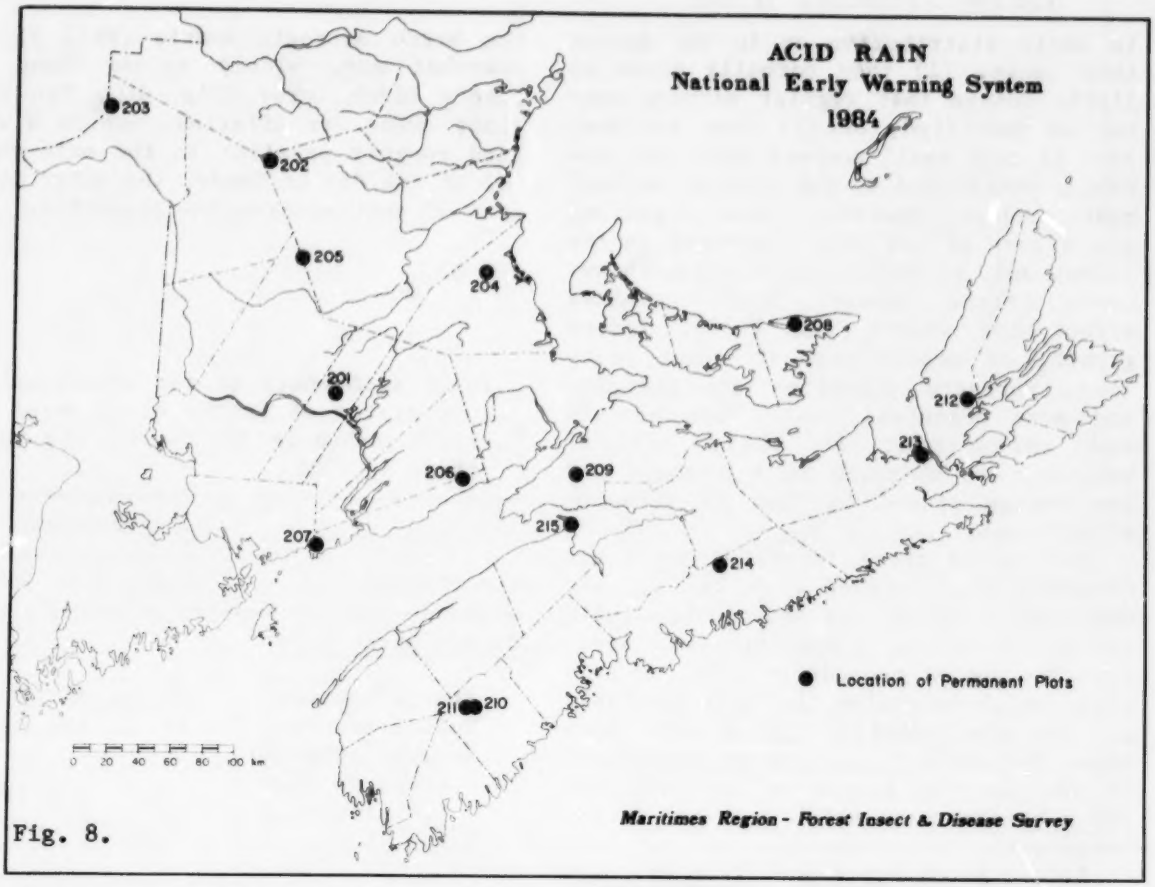


Fig. 8.

Information collected is being analyzed and results will be reported when available.

FOREST PEST ASSESSMENT IN PLANTATIONS

The increasing importance of planted trees in forest management resulted in the initiation of an annual plantation - assessment program. The lessons learned from agriculture and from experience with large-scale forest plantings suggest that tracts of even-aged, single species forests will bring with them special pest problems. Previously insignificant pests may take on new importance and many of the well-known pests may change their habits in the new environment. As our knowledge of pest outbreaks in plantations accumulates, our methods of establishing and tending them must incorporate ways to offset the effects of such pests, if we wish to avoid or minimize losses.

Our plantation surveys will attempt to determine the status of all significant insects and diseases. At least one host species is assessed each year in selected plantations throughout the Maritimes to obtain a general picture of pest problems. This should indicate if there is a need for detailed surveys of all plantations in that specified area to be carried out in cooperation with clients. Although plantation selection is random, new plantations are avoided to eliminate problems associated with site selection and establishment techniques.

In 1984, other work priorities resulted in the cancellation of surveys planned to assess pest conditions in black spruce and red spruce plantations.

CYCLICAL REVIEWS FOR SPECIFIC PESTS

Many pests, although omnipresent in the forest, are not reported annually because (1) there is little fluctuation

in their distribution or in the damage they cause, (2) they normally cause so little damage that regular surveys cannot be justified, or (3) they are present in such small numbers that they are easily overlooked during routine assessment surveys. However, these organisms are a part of the pest component in the forest and, although separately each may cause little damage, their combined effect can weaken the trees, reduce growth, or expose them to other problems. Forestry practices are changing and some organisms, until now obscure and unimportant in their natural habitat, are changing in importance and the damage caused by them is becoming significant.

Several of these 'other' insects and diseases are reviewed each year in the Maritimes, often in connection with surveys involving a specific host species. The number depends on other activities, which determine the time available and the time required for specific surveys. The results provide an assessment of the current status of the organism and a benchmark to which past and future assessments are compared.

Bronze Birch Borer and Birch Ambrosia Beetle. The two insects assessed in 1984, the Bronze Birch Borer, Agrilus anxius Gory, and the Birch Ambrosia Beetle, Trypodendron betulae Swaine, are best discussed together because of the many similarities in their status. The bronze birch borer is considered one of the most destructive insects of birch in North America. It normally attacks only weakened trees and as such is a secondary organism but through its feeding, in the wood and just under the bark, it contributes to the death of affected trees. The birch ambrosia beetle feeds mostly in recently dead or cut trees or tree parts such as branches with high moisture content. It does not contribute to tree mortality but introduces a fungus into the tree which then causes staining of the wood.

Some of the results of the surveys are summarized in Table 5. The distribution of infested stands in the Maritimes was similar for the two insects although the birch ambrosia beetle (Fig. 9) was somewhat more widely spread than the bronze birch borer (Fig. 10). Two distinct areas are affected, one in a wide band roughly parallel to the main channel of the Bay of Fundy, the other in an area of northwestern New Brunswick.

Table 5. Summary of the assessment of the status of bronze birch borer and birch ambrosia beetle in the Maritimes in 1984.

Description	Province N.B.	N.S.	P.E.I.
Bronze birch borer			
Stands examined	31	37	6
Insect present, %	32	16	17
Ave. of infested trees in affected stands, %	6.9	6.7	32
Range, %	4-16	4-12	32
Birch ambrosia beetle			
Stands examined	31	37	6
Insect present, %	35	27	83
Ave. of infested trees in affected stands, %	6.5	10.4	11.0
Range, %	4-16	4-24	4-24
Both insects			
Stands affected by any combination of the two insects	13	12	5
Bronze birch borer alone, %	17	15	*
Both insects, %	58	31	*
Birch ambrosia beetle alone, %	25	54	*

*Sample too small for comparison

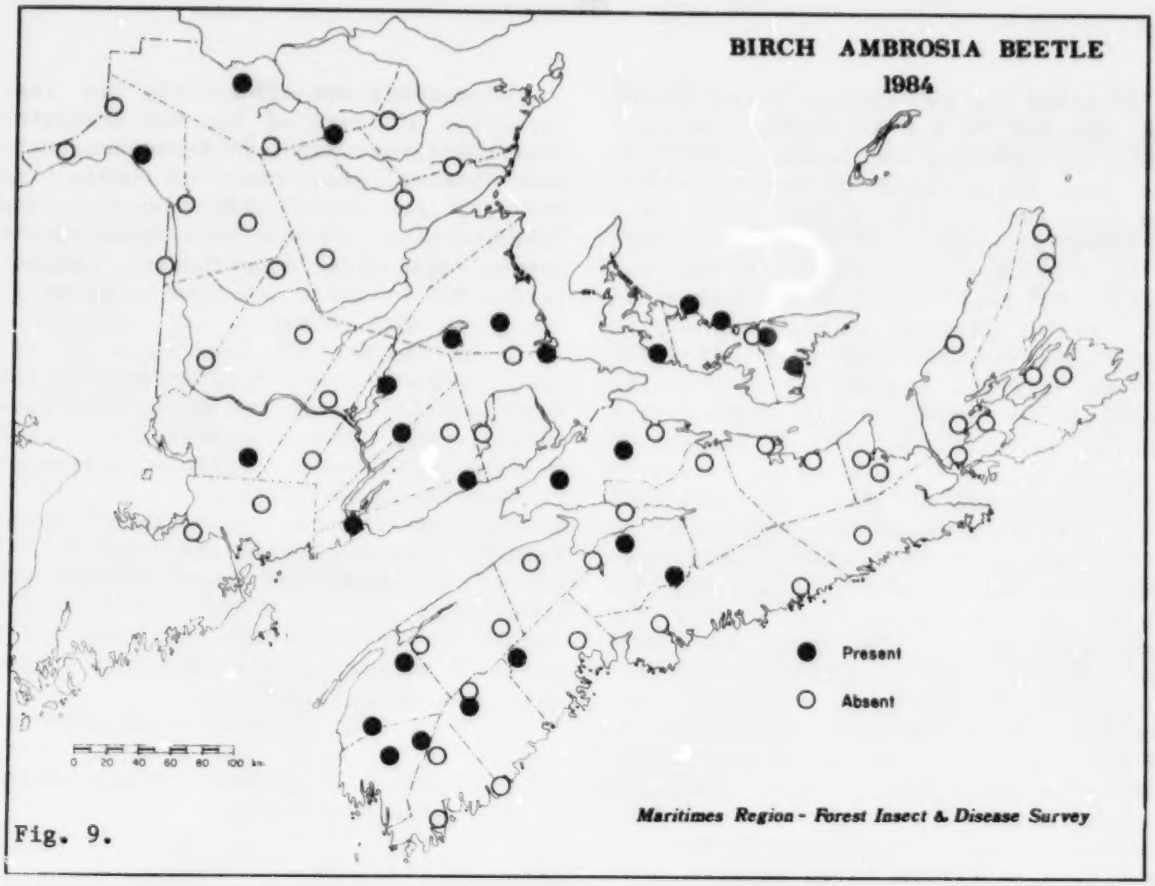

BIRCH AMBROSIA BEETLE
1984
Present
Absent
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 9.

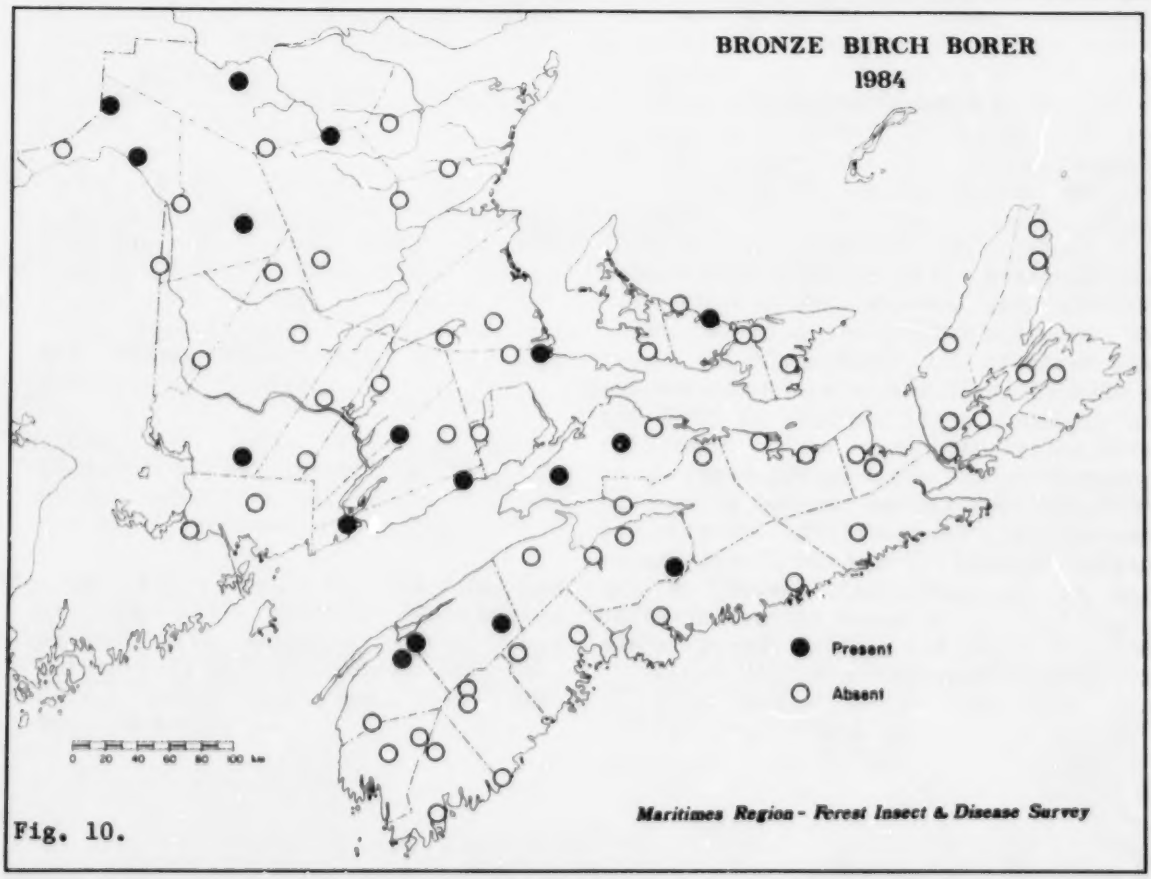

BRONZE BIRCH BORER
1984
Present
Absent
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

Fig. 10.

Although the two insects often occurred together in the affected stands and the birch ambrosia beetle was present at the same proportions in New Brunswick and Nova Scotia (83% vs 85%) there is a striking difference in the involvement of the bronze birch borer in the two provinces. This insect was present in 75% of the affected stands examined in New Brunswick while less than half (46%) of the affected stands in Nova Scotia harbored the bronze birch borer. This can be taken either as an indication that the bronze birch borer is less of a factor in causing birch mortality in Nova Scotia than in New Brunswick or that birch is under considerably more stress in New Brunswick, providing the insect with a better opportunity for successful attack. Not enough data were available from Prince Edward Island for comparison, however, the highest infestation of bronze birch borer was recorded in that Province. In Prince Edward Island National Park, 32% of the trees were affected near a picnic site where the insect had already caused significant tree mortality in an adjacent area in previous years.

ACKNOWLEDGEMENTS

This report is the result of the combined effort of all members of the Forest Insect and Disease Survey: L.J. Coady, J.R. Cormier, C.M. Dobson, K.J. Harrison, J.E. Hurley, A.M. Jones, C.D. MacCall, A.W. MacKay, L.P. Magasi, O.A. Meikle, W.R. Newell, D.P. Ostaff, B.A. Pendrel, S.E. Pond and F.A. Titus. We wish to thank our summer students and the numerous staff members at MFRC who contributed in many ways. Some are mentioned in the appropriate sections of the report but special thanks go to Marg Cameron, Ed Kettela, Don Marks, and Thaddee Renault. Much of the information on the status and control of the spruce budworm is based on data provided by other organizations as listed in the appropriate chapter.

Information contributed by the Pest Detection Officers of the New Brunswick Department of Natural Resources, the Nova Scotia Department of Lands and Forests, and the Prince Edward Island Department of Energy and Forestry is acknowledged and appreciated. Special thanks go to those who participated in the gypsy moth surveys.

Parks Canada, the Department of Natural Resources of New Brunswick, the Department of Lands and Forests of Nova Scotia, the Bowater-Mersey Ltd., and private individuals operated light traps during the summer months.

The contribution and cooperation of private citizens and of personnel at all levels of industrial organizations are noted with thanks. Their effort on our behalf in so many ways not only makes our work easier but also makes us a more effective unit.

I would like to express my personal thanks to my staff who made me 'look good' on many occasions through their hard work and dedication.

LIST OF PUBLICATIONS

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OTHER INSECTS AND DISEASES

OTHER INSECTS AND DISEASES

This table lists, alphabetically by common name, most insects and diseases encountered in the Maritimes in 1984 not discussed in detail. Inclusion in the table does not imply that the organism is necessarily of lesser economic importance than those discussed in the text. It may be that an organism, e.g., whitemarked tussock moth, is at an ebb of biological activity and did not cause enough concern in 1984 to warrant detailed discussion. It may be that although "severe", an organism, e.g., Douglas fir needle blight, was only of localized importance in 1984.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Abiotic conditions Winter drying	Conifers	N.B. P.E.I.	Caused browning of blue, Norway, and white spruce, Austrian, mugho, Scots, and white pine and cedar in Kings County, N.B. Light discoloration of ornamental trees in parts of Kings County, P.E.I.
Ice damage	Conifers Hardwoods	N.S. P.E.I.	Accumulation of ice from freezing rain in later winter and early spring broke tops and branches of trees causing varying degrees of damage. Poplars and white birch were mostly affected in eastern Prince and northern Queens counties in Prince Edward Island. Both hardwoods and conifers were damaged in widespread areas of Cape Breton Island and in northern Colchester County, N.S.
Storm damage	Conifers Hardwoods	N.B.	Extensive wind and snow damage in parts of Madawaska and Restigouche counties. About 33% of mature and semimature balsam fir wind-thrown or damaged in one 20-25 ha area.
Late frost	Balsam fir and other species	N.B. N.S.	New shoots of balsam fir damaged in Christmas tree plantations or in natural regeneration in Charlotte, Sunbury, and Kings counties in New Brunswick, severe damage in many areas in Inverness County, N.S., an average of 20% of new shoots killed in nine scattered areas in eastern Nova Scotia. Hardwoods and conifers both affected in some areas.
Flooding	Hardwoods	N.B.	Many hardwoods with small off-color leaves as a result of a prolonged period of high water, northwest of French Lake along Brownhouse Brook, Sunbury County.

Roadside salt damage	White pine	N.B.	Discolored lower branches of roadside trees, mainly along parts of Highway No. 8 in York, Northumberland and Gloucester counties.
Alder flea beetle *Altica ambiens alni* Harr.	Alder	Region	Pockets of leaf browning, often moderate or severe, over much of mainland Nova Scotia; present in Kings and Queens counties, P.E.I., but at reduced levels of intensity since 1983; common throughout Charlotte County, and patches of severe browning at a few locations in York County, N.B.
Ambermarked birch leafminer *Profenusa thomsoni* Konow	White birch	N.B. N.S.	Leaf browning of moderate intensity at three locations in Restigouche County, N.B., highest in Mount Carleton Provincial Park. Also observed at one location each in Carleton County, N.B. and Queens County, N.S. at lower levels of intensity.
Animal damage Porcupine	Balsam fir Jack pine Red pine Red spruce Tamarack White spruce	N.B. N.S.	Porcupine damage common through New Brunswick and western Nova Scotia. Counts in damaged areas were 28% of trees injured at 9 locations in New Brunswick and 9% at 3 locations in western Nova Scota.
Mice and (or) rabbits	Red pine Scots pine Tamarack	N.B. P.E.I.	Between 20 and 40% of the trees were killed in a young, 10-ha Scots pine plantation at McGivney, York County, N.B. Damage was extensive in many plantations of various species in Prince County, P.E.I. At Albany Village, 94% of the tamarack and 65% of the red pine were killed in a 16.2-ha plantation established in 1983. Pine in older plantations and windbreaks were also damaged to varying degrees. In a small 10-year-old Scots pine plantation at St. Nicholas, 68% of the trees were dead and another 11% girdled, but still living.
Anthracnose of maple *Kabatiella apocrypta* (Ell. & Ev.) Arx	Red maple Sugar maple	Region	Common in western New Brunswick, reported from Colchester, Lunenburg and Annapolis counties, N.S. and Queens County, P.E.I., browning of foliage, however, was only light or trace.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Ash rust *Puccinia sparganioides* Ell. & Barth.	Ash	Region	Widespread at varying levels of intensity, often severe or moderate, in western Nova Scotia in 1984. Repeated severe attack causing twig and branch mortality in some communities, notably in Shelburne, Shelburne County. Infection levels reduced from last year at Middle Cape, Cape Breton County. Only light infections noted in southern New Brunswick in 1984. Not reported in Prince Edward Island.
Aspen leafroller *Pseudexentera oregonana* (Wlshm.) Birch-aspen leafroller *Epinotia solandriana* (L.) Darkheaded aspen leafroller *Anacampsis innocuella* (Zell.) Large aspen tortrix *Choristoneura conflictana* (Wlk.) Lightheaded aspen leafroller *Compsolechia niveopulvella* (Cham.) Spotted aspen leafroller *Sciaphila duplex* (Wlshm.)	Largetooth aspen Trembling aspen	Region	Leafrollers present at locations scattered throughout much of the Region, damage not exceeding light.
Aspen skeletonizer *Phratora purpurea purpurea* Brown	Trembling aspen	N.S. P.E.I.	Populations present but low at isolated locations in each of the three counties in Prince Edward Island and reported at one location in Annapolis County, N.S. Not observed at Orwell, Emyvale, North Wiltshire and Brookfield, Queens County, and Middleton, Prince County, P.E.I. where 20-40% leaf skeletonizing occurred in 1983.
Bagworm *Thyridopteryx ephemeraeformis* (Haw.)	Cedar	N.B.	Found on a pyramidal cedar at Perth-Andover, Victoria County. New record for the Region.

Bark weevil *Hylobius congener* D.T.	Black spruce Red pine Scots pine White spruce	N.S.	Extensive mortality of newly transplanted trees in some plantations in Antigonish and Guysborough counties. The role of this insect, implicated as the organism responsible will be subject to further investigation in 1985.
Birch casebearer *Coleophora serratella* (L.)	Alder White birch Wire birch	Region	Moderate or severe leaf browning of white birch and alder in Charlotte, York, and St. John counties in New Brunswick, in Pictou, Guysborough, and Cape Breton counties in Nova Scotia and in patches throughout Prince Edward Island. In Prince Edward Island, wire birch also affected, usually to a greater degree than the other hosts.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Wire birch	Region	Abundant throughout the Region at various levels of intensity with more severe browning of the preferred host, wire birch.
Browning of larch shoots and branches	Tamarack	N.S. P.E.I.	This condition, of unknown cause, reported for the first time in 1983, was much reduced in incidence and intensity and caused only light browning in a few areas of central Nova Scotia. Not found in Prince Edward Island in 1984.
Cedar leafminers *Argyresthia aureoargentella* Brower *Argyresthia freyella* Wlshm. *Argyresthia thuiella* (Pack.) *Pulicalvaria thujaella* (Kft.)	Cedar	Region	In Nova Scotia, *A. thuiella* caused light browning of ornamentals at locations in Lunenburg and Pictou counties. In New Brunswick, the areas of moderate and severe browning reported in 1983 in St. John County and in the west central part of the Province was not as heavy this season. In Prince Edward Island, the moderate and severe browning which occurred in the St. Eleanors, Muddy Creek, Sandy Cove, Miscouche and Freeland areas of Prince County was reduced to light.
Cedar tree borer *Semanotus ligneus* (F.)	Cedar	N.B.	Attack continued over the 700 km² area, near Portage Lakes, Northumberland and Restigouche counties, with an increase in tree mortality; tree condition continues to deteriorate along the Martinon By-pass, St. John County; also found attacking a few trees at Cedar Brook, Madawaska County.
Cherry casebearer *Coleophora pruniella* Clem.	Trembling aspen	P.E.I.	Population levels were unchanged from 1983 with moderate and severe browning restricted to a few areas less than 2 ha in size in Queens and Kings counties.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Cherry blight	Pin cherry	Region	Present at a few locations in western New Brunswick, and at one location in Kings County, P.E.I., much reduced from 1983.
Dieback of ash	Ash	N.B.	Mortality of top branches of all ash trees at Robinsonville, and only of older trees at English Island Road, St. Jean Baptiste, Restigouche County.
Douglas fir needle blight *Rhabdocline* sp. and Douglas fir needle cast *Phaeocryptopus gaeumannii* (Rohde) Petr.	Douglas fir	N.S.	Light and moderate damage again occurred in a 1.2-ha plantation at Barss Corner, Lunenburg County.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir Spruce	Region	Populations continued low.
Eastern tent caterpillar *Malacosoma americanum* F.	Apple Cherry Trembling aspen	Region	Common on roadside trees and bushes at many locations in eastern New Brunswick where counts of nests ranged as high as 13/100 m^2, low population levels in the western part of the Province. In Nova Scotia, nests were plentiful in Hants County and the Brickton to Paradise area of Annapolis County, present at low levels in Lunenburg, Pictou, Colchester, and Antigonish counties, and in Prince Edward Island.
Elm leaf beetle *Pyrrhalta luteola* (Mull.)	Elm	N.B.	Browning of shade trees severe in Fredericton for the second consecutive year. Light browning observed in Newcastle, Northumberland County and Bathurst, Gloucester County.
Elm leafminer *Fenusa ulmi* Sund.	English elm	Region	Leaf browning of varying intensity, often severe in communities in Queens, Lunenburg, Colchester, Hants, Kings, Pictou, Antigonish, and Inverness counties in Nova Scotia, in all counties in Prince Edward Island and in Westmorland County in New Brunswick. A reduction in intensity of browning from 1983 levels occurred at Richmond, Prince County, P.E.I., and at Sackville, N.B.

European pine sawfly *Neodiprion sertifer* (Geoff.)	Red pine Scots pine	N.B. N.S.	Defoliation of ornamental trees severe at Bridgewater and Chester, Lunenburg County, moderate at Rockingham, Halifax County, N.S. A few larvae were found in Pictou and Cape Breton counties, N.S. and in Westmorland, N.B.
European pine shoot moth *Rhyacionia buoliana* (D. & S.)	Red pine Scots pine	N.S. P.E.I.	Populations at about the same level as 1983. Intensity of attack varied greatly between locations. In Nova Scotia, a plantation in the Chignecto Game Sanctuary had 92% of the trees infested. At two widely separated locations in Yarmouth and Colchester counties, Christmas tree plantations were rendered unsuitable for market as a result of severe attack.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Black spruce Red spruce White spruce	Region	Populations low, distributed widely throughout the Region.
Fall webworm *Hyphantria cunea* (Dru.)	Deciduous	Region	Mainly on roadside trees and bushes throughout Prince Edward Island with a noticeable increase in Queens and Kings counties. Scattered nests were observed throughout much of mainland Nova Scotia, with an increase in incidence in the eastern part of the Province. Found at one location in New Brunswick in Sunbury County.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine	Region	The disease was common throughout New Brunswick. At seven locations where the disease was known to be present levels of infected branches ranged from 11 to 44%. The infection reported in Kouchibouguac National Park, Kent County in 1983 as causing moderate and severe branch mortality with some small scattered trees being killed, continued to cause problems this season. At Park Corner, Queens County, P.E.I., in a small plantation about 3% of the trees averaged 14 galls each. Not reported in Nova Scotia.
Hemlock looper *Lambdina fiscellaria fiscellaria* (Guen.)	Conifers Hardwoods	Region	Populations remained low throughout the Region.
Introduced pine sawfly *Diprion similis* (Htg.)	White pine	N.B.	Moderate defoliation of an ornamental tree at Temperance Vale, York County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine Scots pine	N.B. N.S.	In 1983, damage of variable intensity occurred over much of the area of natural growing jack pine in east-central New Brunswick. Populations decreased dramatically this season with only two locations in Northumberland County with noticeable defoliation. The insect was also collected from locations in Sunbury, York and Kent counties but defoliation did not exceed light. Present in a Scots pine plantation in Parrsboro, Cumberland County, N.S.
June beetles *Phyllophaga* sp.	Scots pine	N.S.	White grubs present in a small plantation at Middle Musquodoboit, Halifax County, where many trees are in a state of deterioration. The area has a heavy grass cover and the cause-effect relationship as regards tree damage is unclear.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Region	Needle mining light and (or) moderate at locations scattered throughout mainland Nova Scotia and Inverness County on Cape Breton Island. Populations low in New Brunswick and Prince Edward Island.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Region	Populations of this important defoliator of larch remained low throughout the Region. Found at only one location in Nova Scotia, and one in Prince Edward Island.
Leaf spot of oak *Actinopelte dryina* (Sacc.) Hoehn.	Red oak	N.B.	Common at many locations in Charlotte County. At Mohannes 50-70% of the foliage of most red oak in the area was affected.
Leaf spot *Guignardia populi* G. Thompson	Trembling aspen	N.B.	Foliage browning did not occur at Meadow, Albert County and Ratter Corner, Kings County where severe leaf discoloration was evident in 1983.
Leaf spot of poplar *Drepanopeziza tremulae* Rimpau Leaf rust of poplar *Melamspora medusae* Thuem.	Trembling aspen Tamarack	Region	Levels of infection greatly reduced from 1983. Found at only a few scattered locations.

Leaf and twig blight of aspen *Venturia macularis* (Fr.) E. Muell. & Arx	Trembling aspen	Region	Common throughout New Brunswick, causing light and moderate damage. Damage levels light at scattered locations in Nova Scotia and Prince Edward Island.
Leaf blotch of horse-chestnut *Guignardia aesculi* (Peck) V.B. Stew.	Horse-chestnut	Region	Moderate and severe browning of a few ornamentals in Digby and Annapolis counties, present throughout eastern Nova Scotia. Light at scattered locations throughout Prince Edward Island, except severe at Souris, Kings County. Moderate at a few locations in Charlotte and York counties, N.B.
Lichens *Xanthoria* and *Hypogymnia physoides*	Conifers Hardwoods	N.B.	Common in the vicinity of cement plant and lime works at Havelock, Westmorland County. Covering stems and branches of many tree species. Trees do not appear to be adversely affected.
Maple leafroller *Cenopis acerivorana* MacK.	Red maple Sugar maple	Region	Populations generally low in New Brunswick and Nova Scotia. In Prince Edward Island, leafrolling was reduced to light with scattered patches of moderate rolling within the areas in Kings County reported as severe in 1983. Elsewhere in the Province, light at scattered locations in western Prince County.
Mountain-ash sawfly *Pristiphora geniculata* (Htg.)	Mountain-ash	Region	Present throughout the Region causing various levels of defoliation.
Needle cast *Lophodermium pinastri* (Schrad. ex Hook.)Chev.	Red pine	P.E.I.	No additional mortality occurred in the plantations of 3-0 seedlings where 38.7% of the trees died in 1983 from a variety of causes, including needle cast. The surviving seedlings produced healthy shoots in 1984.
Orangehumped mapleworm *Symmerista leucitys* Francl.	Sugar maple Beech	N.S.	Moderate or severe defoliation occurred in parts of Colchester and Halifax counties on about 250 ha reduced from the 1700 ha reported last year. Larvae were found at a few other locations in the Province, but defoliation was negligible.
Poplar leaffolding sawfly *Phyllocolpa* sp.	Trembling aspen	Region	Present at a few locations throughout the Region with the greatest concentration in Pictou County, N.S. where six counts showed an average of 13% of the leaves infested with a range of 1 to 25%.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Poplar serpentine leafminer *Phyllocnistis populiella* Cham.	Largetooth aspen Trembling aspen	Region	Present at various levels of intensity in New Brunswick but highest in the northern one-third of the Province. Populations lower in the western part than in 1983. Recorded in low numbers in Hants and Annapolis counties, N.S. Populations remained low in Prince Edward Island averaging less than 5% of leaves affected at 11 locations.
Potebniamyces canker *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	N.B. P.E.I.	Identified on a few trees from York and Carleton counties, N.B. and Kings County, P.E.I.
Redheaded jack pine sawfly *Neodiprion virginianus* complex	Jack pine	N.S.	Light and moderate loss of old foliage over a few hectares in a young plantation in the Perch Lake area, Pictou County, and of some trees in a plantation at East Earltown, Colchester County.
Red pine sawfly *Neodiprion nanulus nanulus* Schedl	Red pine	N.S.	Causing various levels of defoliation of ornamentals throughout much of the Province.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Beech	N.S.	The insect in combination with the orangehumped mapleworm caused considerable defoliation of beech over a few hectares south of Riversdale, Colchester County. Not found in the area near North Kemptville, Yarmouth County where some patchy severe defoliation occurred in 1983.
Satin moth *Leucoma salicis* (L.)	Balsam poplar Silver poplar Trembling aspen	Region	Light and moderate defoliation of ornamental trees in many municipalities, particularly in western New Brunswick. Moderate and severe defoliation of about 10 ha of aspen in a natural forest at Popple Depot, Northumberland County, N.B. within the area where extensive leaf skeletonizing occurred in the fall of 1983. Defoliation of ornamental poplars at various levels of intensity at locations in Hants, Digby, Inverness, and Richmond counties, N.S. General reduction in population levels in Prince Edward Island with severe defoliation reported from only three locations.

Spider mites	Conifers	N.B. N.S.	Found on a variety of coniferous hosts throughout much of New Brunswick and Nova Scotia, in natural forests, plantations, nurseries and on ornamentals. In New Brunswick, moderate damage occurred in a balsam fir Christmas tree plantation in Sunbury County and on tamarack in a plantation in York County. In Nova Scotia, needle browning at various levels of intensity was common on young larch trees in much of eastern mainland, and parts of Cape Breton Island. No damage was observed in the plantation at New Ross, Lunenburg County where populations at damaging levels were present in 1983.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Region	Populations low. Collected from various locations in New Brunswick and Nova Scotia. Not found in Prince Edward Island.
Stillwell's Syndrome (sudden death of balsam fir trees)	Balsam fir	Region	Balsam fir trees stressed by repeated budworm defoliation are susceptible to attack by a regime of organisms normally considered to be of a secondary nature. The group includes bark beetles and weevils, sawyer beetles, horntailed wood wasps, Armillaria root rot, and many others. The sudden death of balsam fir trees was first reported in 1980 in localized areas of New Brunswick. The number of trees affected has varied over the intervening years but the condition continues to persist and become more widespread with losses accumulating. In New Brunswick, red trees were common this season but were particularly prevalent in the northwestern part of the Province from Woodstock north and in the Canterbury area, York County. In Nova Scotia, scattered red trees were present in parts of Cumberland, Colchester and Halifax counties, and on the Cape Breton Highlands. In Prince Edward Island, reported from one location in Queens County.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Alder	N.B. P.E.I.	Severe defoliation over about 1 ha at Morell East, Kings County, P.E.I., and an area of similar size at Petit - Paquetville, Gloucester County, N.B.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Uglynest caterpillar *Archips cerasivoranus* (Fitch)	Cherry	Region	The population increase evident in 1983 did not continue. Numbers low throughout the Region.
Whitemarked tussock moth *Orgyia leucostigma* (J.E. Smith)	Conifers Hardwoods	Region	Populations of this economically important forest pest remained low. The insect was collected on alder at Ingram River, and balsam fir at Musquodoboit Harbour, Halifax County, and at Ogden, Guysborough County, N.S. Collected in low numbers at Lincoln, Sunbury County, and Fredericton, York County, N.B.
White pine blister rust *Cronartium ribicola* J.C. Fischer	White pine	N.B. N.S.	Light damage at locations throughout eastern New Brunswick and at Garden of Eden Barrens, Pictou County, and Queensland, Halifax County, N.S.
White pine needle blight	White pine	Region	This condition results in browning of needles, often affecting just the tips. It may occur on single or small groups of trees. Mature or semimature trees are most frequently affected but may be found on younger trees. The cause of this condition is unknown. In 1984, foliage discoloration occurred at scattered locations in York, Charlotte, Sunbury, Kent, Northumberland, Queens, and Kings counties, at various levels of intensity. In Nova Scotia, needle discoloration was found at a few locations in the western part of the Province and at one location in Pictou County. This condition was generally reduced from last year in both New Brunswick and Nova Scotia and was not found in Prince Edward Island.
White pine weevil *Pissodes strobi* (Peck)	Blue spruce Norway spruce Mugho pine Scots pine White pine White spruce	Region	Caused leader mortality to a variety of hosts, throughout much of the Region.

Willow blight *Venturia saliciperda* Nuesch	Willow	Region	Present at various levels of intensity, usually on ornamentals, at locations in York, Carleton, Victoria, Madawaska, and Restigouche counties, N.B.; Digby, Annapolis, Kings, Hants, Colchester, Pictou, and Antigonish counties, and a few points in Cape Breton Island, N.S. Not reported from Prince Edward Island.
Willow flea weevil *Rhynchaenus rufipes* (Lec.)	Poplar Willow	Region	Light leaf browning of ornamental willows and occasionally poplars occurred at various locations in New Brunswick, in Restigouche, Northumberland, York, Kings, St. John, Albert, and Westmorland counties. Browning of ornamental willows was widespread in mainland Nova Scotia usually of moderate, occasionally severe intensity. In Prince Edward Island, the insect again caused severe browning of bayleaf willow at Bideford and Ellerslie, Prince County; Stanhope, and North River, Queens County. Severe browning of bayleaf willow occurred for the first time at Bloomfield and Springhill, Prince County.
Wood and (or) bark boring insects *Asemum striatum* (L.) *Cydia inopiosa* (Heinr.) *Dendroctonus valens* Lec. *Filatima* sp. *Hylurgops pinifex pinifex* (Fitch) *Monochamus* sp. *Orthotomicus caelatus* (Eich.) *Pissodes* sp. *Pityogenes plagiatus plagiatus* (Lec.) *Pityophthorus* sp.	Red pine	N.B.	No evidence of further decline in the plantation at Meadow Brook, Kent County where 8% mortality was reported in 1983 as a result of activity by a complex of insects.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce	Region	Defoliation was moderate or severe in small plantations of white spruce and black spruce and light on red spruce at scattered locations in Queens County, Prince Edward Island. The insect was collected at a few locations in western Nova Scotia and at one location in northwestern New Brunswick without noticeable defoliation.